SHUAIB, KHALIFA YAQUB

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RESEARCH INTERESTS

1. Mechatronic System Design and Modeling
2. Embedded Control Systems and Robotics
3. Intelligent Agricultural Systems
4. Data-Driven Optimization in Engineering Systems
5. Low-Cost Precision Instrumentation
6. Cyber-Physical Systems and IoT Architecture

EDUCATION

Afe Babalola University (ABUAD) – Ado-Ekiti, Ekiti State October 2023
B.Eng Mechatronics Engineering – *First Class Honours*
CGPA: 4.8/5.00 (Top 5% of class)
Undergraduate Thesis: *Development of Quadcopter for Aerial Irrigation and Herbicide Spraying with Feedback Mechanism*
Relevant Coursework: Engineering Math (I-III), Robot Design and Manufacturing, Full Automation Technology, Systems Modelling and Simulation, Control Engineering I & II, Process Automation, Computer Software and Hardware Development

RESEARCH EXPERIENCE

AI-Driven Feed Optimization in Aquaculture – Ibadan, Oyo State January 2025 – December 2025

- *Hypothesis Testing:* Designed a comparative feeding framework using multiple linear regression (OLS) to predict optimal feed quantity as a function of biomass estimate, water temperature, dissolved oxygen, and pH, testing the null hypothesis that data-driven scheduling does not reduce Feed Conversion Ratio (FCR) by more than 10% relative to fixed manual feeding schedules.
- *Experimental Design:* Conducted a 4×2 factorial pond experiment (8 ponds total) over two African catfish production cycles (~10 months), applying one-way ANOVA to evaluate inter-pond differences in growth rate, FCR, and biomass yield.
- *System Identification:* Characterised the non-linear dispensing dynamics of an auger-based feeder by estimating mass flow rate (g/rev) across three auger geometries, evaluating model fit using RMSE between commanded and measured feed mass.
- *Results:* Achieved an average ~12% reduction in FCR in AI-scheduled ponds relative to manual control, with reduced inter-pond growth variance under comparable stocking densities.

Research Focus: Experimental design, Non-linear System Identification, and Multi-variate Performance Modeling.

ENGINEERING PROJECTS

IoT-Based Modular Aquaculture Automation System (Patent Pending) December 2025

- Cyber-Physical Modeling: Developed an illustrative discrete-event simulation (SimPy) to estimate end-to-end message latency and delivery timing in an MQTT-based supervisory control architecture under intermittent-connectivity conditions.
- Communication Protocol: Implemented a publish/subscribe MQTT architecture supporting 4 data publishes per minute per node, sufficient for supervisory monitoring and control, while maintaining stable operation under intermittent connectivity and constrained power budgets.
- Power Path Management and Transient Stability: Validated system robustness using a multi-stage power distribution module with regulated switchover between PWM-controlled solar input and mains supply, ensuring uninterrupted operation during transient source loss.

Engineering Focus: Distributed control, system robustness, real-time constraints.

Handheld Ophthalmoscope for Mobile Phone Fundoscopy January 2025

- Mechanical Fitment: Conducted a tolerance analysis on 3D-printed housing geometries and reciprocating helical gear mechanisms to maintain optical axial alignment within ±2mm, compensating for FDM shrinkage and layer-height variance.
- Applied Ray Tracing principles to minimize optical aberration in a 20D lens system, achieving a 15% improvement in peripheral image clarity.

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- Optimised LED diffuser geometry to achieve >50% illumination uniformity across the fundus field of view, reducing specular reflection in digital captures.

Engineering Focus: Opto-mechanical integration, tolerance analysis, low-cost instrumentation.

Embedded Vehicle Monitoring and Utilization Modeling System – Warri, Delta State October 2024

- Data-Driven Utilization Modeling: Implemented a Multiple Linear Regression model to quantify commercial vehicle operational costs by analyzing engine runtime, distance, and passenger load.
- Signal Conditioning: Implemented an array of sensors to capture operational parameters, using firmware-level filtering to minimize noise in the raw data stream before logging to non-volatile memory.
- Embedded Security: Integrated secure data transmission protocols for post-hoc analysis, ensuring the integrity of utilization metrics for commercial fleet management.

Engineering Focus: Embedded sensing, system modeling, data-driven estimation.

Rocker-Bogie Rover – CSTD, Abuja August 2021

- Kinematic and Mobility Modeling: Designed a 6-wheel independently actuated mobility platform utilizing a 3-DoF passive suspension mechanism, implementing a differential tie-rod constraint to maintain chassis levelness and ensure ground-contact continuity across all wheels during traversal.
- Static Stability Analysis: Calculated the Center of Gravity and tipping margins to ensure static stability on inclines up to 45^{o}, optimizing load distribution across the drivetrain.
- Iteratively tuned motor-gear ratios to match required torque-speed curves, reducing mechanical misalignment through high-tension tie-rod interfaces.

Engineering Focus: Mechanism design, drivetrain selection, mobility modeling.

Wireless Control Quadruped Robot – NCAIR, Abuja May 2022

- Locomotion Control: Investigated Crawling Gait Synchronization for a 12-DOF quadruped, implementing open-source kinematic frameworks to coordinate servo-actuator positions for stable forward and lateral motion.
- Embedded Communication: Optimised wireless control latency using low-power transceiver modules, ensuring real-time response for locomotion commands.

Engineering Focus: Locomotion control, embedded actuation.

Capstone Thesis: Quadcopter for Precision Spraying – ABUAD, Ekiti State June 2023

- Drivetrain Optimization: Selected Actuator-Propeller pairings based on a Thrust-to-Weight Ratio (T/W) of 2.2:1, ensuring a 25% safety margin for disturbance rejection during wind gusts.
- Feedback Control: Integrated ultrasonic liquid-level sensing into the flight-control loop, automating the "Return-to-Home" (RTH) sequence upon reaching the 10% payload threshold.
- Dynamic Payload Compensation: Leveraged ArduPilot's PID control architecture to manage flight stability under variable-mass conditions, tuning the thrust-hover-throttle parameters to account for a 20% mass reduction during liquid depletion

Engineering Focus: Rigid-body dynamics, actuator selection, feedback control, system integration.

PROFESSIONAL EXPERIENCE

Terra Industries (formerly TerraHaptix) April 2026 – Present

Mechatronics Engineer – Idu, Abuja

- Redesigned sentry tower control architecture using an Nvidia Jetson platform, implementing tamper detection, PTZ control, and secure video transmission via Python and systemd services

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- Designed and fabricated mechanical components for drone, UGV, and sentry tower platforms using CAD and FDM 3D printing
- Developed custom PCBs for electrical and system integration across multiple hardware projects

National Agency for Science and Engineering Infrastructure (NASENI) January 2024 – October 2024
Manufacturing Engineering Intern (NYSC) – Idu, Abuja

- Design for Manufacturability (DfM): Created CAD models for a compressed air motor, performing Finite Element Analysis (FEA) to identify high-stress concentrations in the piston-crank interface.
- System Prototyping: Conducted cost-performance optimization for CNC machine components, reducing estimated fabrication costs by 25% without compromising structural rigidity or spindle precision.
- Maintained detailed engineering documentation, design iterations, and fabrication records to support traceability and reproducibility.

FundusAI LTD November 2022 – August 2025
Embedded Systems Engineer (Part-Time / Project-Based) – Wuye, Abuja

- *Note: Concurrent with undergraduate studies (2022–2023) and National Service (2024).*
- Hardware-in-the-Loop (HiL): Designed and validated multi-layer PCB architectures, implementing LDO and Switching Regulator circuits to optimize power efficiency in portable diagnostic devices.
- Mechatronic Integration: Implemented the convergence of optical sensors and embedded firmware, utilizing Interrupt-Driven Data Acquisition to ensure synchronised image capture and flash triggering.
- Developed structured system documentation to support iterative prototyping and future manufacturing.

National Center for Artificial Intelligence and Robotics (NCAIR) March 2022 – August 2022
Prototyping Intern – Wuye, Abuja

- Design for Additive Manufacturing: Optimised mechanical components for UAV and quadrupedal platforms, accounting for anisotropic material properties and structural infill densities in FDM-based 3D printing.
- Rapid Mechatronic Prototyping: Executed the full lifecycle of robotic development, from Subtractive Manufacturing (CNC) of structural frames to the fabrication of bespoke PCBs via chemical etching for signal routing and power distribution.
- System Integration: Validated the interoperability of high-torque actuators and microcontrollers within unmanned systems, ensuring mechanical clearances and electrical noise isolation.

Centre for Satellite Technology Development (CSTD) July 2021 – September 2021
Design Intern – Lugbe, Abuja

- Structural Subsystem Modeling: Contributed to the architectural modeling of CubeSAT frames, focusing on volume-to-mass optimization
- Led mechanical design and simulation of a rocker–bogie rover platform for terrain traversal analysis.

TECHNICAL PROFICIENCIES

Design & Simulation: SOLIDWORKS, Fusion 360, AutoCAD
Electronics: Altium Designer, PCB fabrication
Computation: MATLAB, Mathcad
Programming: C/C++, Python, SQL, JavaScript
Embedded Systems: Microcontrollers, sensors, actuators
Languages: English (Fluent), French (Basic), Hausa (Fluent)

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PROFESSIONAL AFFILIATION

- ***Graduate Member*, Nigerian Society of Engineers (NSE)** – Member ID: 99289 January 2026

AWARDS & GRANTS

- **PTDF Overseas Scholarship Scheme (OSS) Award** — Full, merit-based funding for graduate studies following a highly competitive national selection process.
- **Fourth Industrial Revolution Application Research Grant** — ₦10,000,000 (Federal Government of Nigeria)
- **iHatch 2.0 Winner** — $15,000 (National Information Technology Development Agency (NITDA))
- **Founder's Award for Academic Excellence** (5x) —$300 (Afe Babalola University (ABUAD))

LEADERSHIP & SERVICE

- ***President*,** Nigerian Universities Engineering Students' Association (NUESA), ABUAD
- ***Mentor,*** *ABUAD Study Smart (100+ students, improving average exam performance by 15%)*

REFERENCES

Dr. Joseph Dada, Professor
Department of Electrical and Electronics Engineering
Afe Babalola University, Ado-Ekiti, Nigeria.
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Relationship: Provost of Engineering College

Dr. Temitayo Azeez, Senior Lecturer
Department of Mechanical and Mechatronics Engineering
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Relationship: Final Year Thesis Advisor

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