

ESABU BLESSING OBEHI

Engineering Researcher • Applied DSP, Machine Learning & Decentralized Systems

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Research Profile

Computer Engineering undergraduate and researcher building Africa-centered systems across health, civic tech, and indigenous knowledge protection. Published across applied digital signal processing, machine learning, decentralized infrastructure, and gender equity in STEM, with sole- and lead-author papers grounded in simulation, validation, and live deployment.

Publications & Research

EthnoLedger: A USSD-Blockchain Protocol for Indigenous Knowledge Protection

DeSci Lagos · Lead Author · 2025

- Designed a hybrid GSM-blockchain architecture pairing USSD infrastructure with Polygon (EVM-compatible Layer 2), so knowledge holders without internet access can register and protect indigenous knowledge on-chain.
- Built a delegated signing model using AES-256-GCM encryption and PBKDF2 key derivation; ran Monte Carlo simulations ($n=500$) to test latency and reliability under variable GSM conditions.
- Compared cost-efficiency of traditional patent registration against blockchain proof-of-existence, and analysed legal weight under Nigeria's Evidence Act (2011) and international IP frameworks.

Predictive Maintenance for Residential Generators using Acoustic Signal Analysis and Remaining Useful Life Estimation

University of Lagos, EEG 213 · Sole Author · 10,460-word paper · 2026

- Built a DSP pipeline (FFT spectral analysis, Butterworth bandpass 50–2000 Hz, time and frequency feature extraction) to detect bearing degradation in petrol generators, a real Nigerian residential pain point.
- Implemented a Remaining Useful Life model using regression-based degradation tracking with 95% confidence intervals ($R^2 = 0.94$ on simulated timelines).
- Validated against the MIMII industrial machinery dataset (80 audio segments, normal vs. anomalous), reaching 87.5% classification accuracy.
- Speced ESP32 deployment (8 kHz sampling, 12-bit ADC) at 47 ms per 1-second window, a 21x real-time speedup with NumPy/SciPy. Selected by class as the most publishable submission.

Female Attrition in African Petroleum Engineering: A Dual-Stage ML Framework

STSE 2026 · Sole Author

- Investigated the "leaky pipeline" by which women are lost at two stages: 45.2% drop out during university and roughly 40% of female graduates never enter or eventually leave the profession.
- Built a dual-stage machine-learning framework (Random Forest, XGBoost, Neural Networks) with SMOTE for class imbalance and SHAP for explainable predictions.
- Contextualised findings for gender equity in African STEM, where women are under 10% of practising petroleum engineers.

A Phased Open-Source SCADA Framework for Nigeria's Power Grid

Research Framework · Sole Author · 2025

- Proposed a phased, decentralized, policy-aligned national SCADA roadmap using OpenPDC and Rapid SCADA, addressing a grid that collapsed 12 times in 2024 with an estimated \$29B in annual economic losses.
- Phase 1 deploys 20 RTUs and 10 PMUs across Lagos and Abuja over existing NETAP fiber, aligned with NERC compliance and IEC 61850 / IEEE C37.118 standards.

Research Artifacts & Selected Projects

GenDoc: Predictive Maintenance Web App

Live: gendoc.streamlit.app

Flask · SQLite · React · Recharts · in-browser DSP

- Generator-health diagnostic platform with a multilingual interface (English, Igbo, Yoruba, Hausa) for non-English-speaking technicians and households.
- Full in-browser DSP: bandpass filtering, 1024-point FFT, nine-feature extraction (time, frequency, cepstral), and a composite health score, with RUL prediction and confidence intervals. User-testing scores: clarity 4.5/5, willingness to use 4.6/5.

RiskIntel: Financial Risk Assessment

Live: riskintel.onrender.com

Python · Flask · XGBoost · Docker

- Hybrid AI and behavioural scoring engine for credit risk: an XGBoost classifier trained on transactional and demographic features, with real-time risk queries and batch processing endpoints.

Engineering Experience

Lead Backend Developer

Verifact (AI Verification System)

May 2025 – Jun 2025

Remote

- Built RESTful APIs wrapping AI inference workflows and integrating TensorFlow/PyTorch models into production, with JWT auth and role-based access control.

Backend Developer Intern

TechyJaunt

Jan 2025 – Mar 2025

Remote

- Shipped maintainable NestJS and Express APIs and owned API documentation that reduced ramp-up time for new developers.

Research & Technical Skills

Signal Processing	FFT, Butterworth filtering, MFCCs, feature extraction, Remaining Useful Life estimation
Machine Learning	XGBoost, Random Forest, Neural Networks, SMOTE, SHAP, scikit-learn
Scientific Python	NumPy, SciPy, Librosa, Pandas
Blockchain	EVM / Polygon, smart-contract interaction, AES-256-GCM, PBKDF2, SHA-256
Embedded	ESP32, Arduino, ADC configuration, embedded DSP
Backend	Node.js, Express, NestJS, Flask, PostgreSQL, MongoDB, REST API design
Methods	Monte Carlo simulation, statistical validation, dataset benchmarking, IEEE-format technical writing

Education

B.Sc. Computer Engineering

University of Lagos (UNILAG) | CGPA: 4.61/5.00 (First Class, Top 5%)

2024 – 2029

Lagos, Nigeria

Leadership & Recognition

- Vice Secretary, IEEE UNILAG Student Branch
- Welfare Secretary, APWEN UNILAG .
- 5x Hackathon Winner: Microsoft AI Skills Hackathon — Winner (VoiceIQ); 1st place, CJID Nigeria (media and civic tech); 2nd place, Curacel; 3rd Runner-Up, LCCI.
- Afro Tech Girls Scholarship recipient.

Professional Memberships

- IEEE (Member No. 101029879): Robotics & Automation, Industrial Electronics, and Industrial Applications Societies.
- Society of Petroleum Engineers (SPE) (Member No. 5934377).