

Richard Djarbeng

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PERSONAL STATEMENT

Full-stack software engineer with a strong background in building scalable, user-friendly web applications across the entire development lifecycle. Core expertise in React and Node.js for front-end and back-end development, with hands-on experience in headless CMS architectures including DecapCMS (formerly NetlifyCMS) and SveltiaCMS. Experienced in embedded programming using C/C++, machine learning model development and deployment with Python (PyTorch, Keras), and cloud infrastructure on AWS and Google Cloud. Collaborates effectively with cross-functional teams across research, engineering, and product contexts. Holds an MSc in Electrical and Computer Engineering from Carnegie Mellon University, with a focus on data science, IoT, and air quality research.

EDUCATION

Carnegie Mellon University

July 2022 – May 2024

MSc Electrical and Computer Engineering

Pittsburgh, PA (and Kigali, Rwanda)

- **Relevant Coursework:** Introduction to Deep Learning, Computer Vision, Internet of Things, Autonomous Driving, Data Analytics, Data Structures and Algorithms, Introduction to Information Security, Cognitive Robotics, Wireless Networks

University of Ghana

November 2021

BSc Computer Engineering

Accra, Ghana

- **Electives:** Software Engineering, Computer Graphics
- **Relevant Coursework:** Object Oriented Programming, C Programming, C++ Programming, Computational Tools, Robotics and Computer Vision, Data Structures and Algorithms, Introduction to Artificial Intelligence, Computer Architecture, Operating Systems

CERTIFICATIONS

AWS Certified Solutions Architect – Associate

June 2026

Amazon Web Services

- **Designing Secure Architectures:** Demonstrated ability to build secure AWS infrastructure using identity management (IAM), data encryption, and network security controls to protect applications and sensitive data.
- **Designing Resilient Architectures:** Proven skills in creating highly available and fault-tolerant systems using Multi-AZ deployments, Auto Scaling, load balancing, and disaster recovery strategies.
- **Designing High-Performing Architectures:** Skilled at selecting appropriate compute, storage, and networking resources, including caching solutions, to deliver fast and scalable applications.
- **Designing Cost-Optimized Architectures:** Expertise in optimizing costs through right-sizing resources, choosing appropriate storage classes, and leveraging flexible pricing models such as Spot Instances.

PROFESSIONAL DEVELOPMENT

Google Get Certified Program

June 2024 – August 2024

Professional Machine Learning Engineer (PMLE) Track

Google Cloud

- Completed intensive instructor-led training and hands-on "arcade" labs with a Google instructor.
- Collaborated with international cohorts across multiple time zones to complete practical machine learning engineering exercises.
- Gained applied experience in production ML workflows, including model training, deployment, monitoring, and MLOps using Vertex AI, AutoML, and BigQuery ML.

EXPERIENCE

Carnegie Mellon University

July 2024 – October 2025

Research Associate

Kigali, Rwanda

- **Environmental Sensor Development:** Responsible for the design and development of low-cost sensor nodes for measuring temperature, humidity, wind speed, and environmental parameters using innovative AI-driven approaches.
- **Data Storage and Management:** Collaborated with the project's principal investigators and external researchers to design a data storage and management framework, ensuring collected environmental data is stored securely and made accessible to project stakeholders.
- **Sensor Testing and Calibration:** Participated in the testing and calibration of sensor nodes using machine learning techniques to improve the accuracy and reliability of low-cost sensors.
- **System Design:** Designed and built web-accessible dashboards for environmental sensor networks, working across the full development lifecycle from requirements to deployment.
- **Academic Paper Preparation:** Collaborated with the research team to prepare and publish academic papers documenting the project's findings and methodologies.

Carnegie Mellon University

January 2024 – May 2024

Research Assistant

Kigali, Rwanda

- **Interdisciplinary Research:** Worked with the mechanical engineering department to research alternative ways of predicting biomass pollutants in the air using a combination of sensor data from aethalometers.
- **Air Quality Prediction:** Improved existing low-cost means of predicting black carbon pollutants using RGB pictures of filters to distinguish pollution from wood burning versus fossil fuel combustion.
- **Data Analysis and Experimentation:** Conducted data analysis on datasets collected over more than 2 years and verified experiments to measure black carbon pollutants.
- **Pollution Source Classification:** Developed computer vision models to classify pollution sources from particulate matter filters using smartphone imagery, enabling low-cost air quality source apportionment. Research featured on the [CMU Africa website](#).

AfriqAir - Kigali Collaborative Research Center

May 2023 – August 2023

Graduate Intern

Kigali, Rwanda

- **Web Dashboard Development:** Developed a production-grade web dashboard using React.js and TypeScript for real-time visualisation and interpretation of air quality data, consuming live sensor feeds from field-deployed instruments.
- **System Design:** Designed system specifications and architecture for an IoT wireless data logging unit, coordinating requirements across hardware and software teams.
- **Prototype Development:** Built a prototype IoT system to automate the diagnostic and data collection process from the Thermofisher TEOM air quality system using Python and C++ for Raspberry Pi and Arduino.

Sorphise GH Ltd

July 2020 – January 2021

Intern

Ghana

- **Web Application Development:** Developed and deployed web applications using JavaScript, PHP, React (GatsbyJS), Netlify, and NetlifyCMS.
- **CMS Integration and Architecture:** Led the adoption of a headless CMS architecture by decoupling website content from application code using NetlifyCMS (now DecapCMS), integrated with GitHub for CI/CD, enabling content editors to update posts, images, and metadata without developer involvement.
- **Scalable Static Site Architecture:** Implemented a scalable static site architecture separating content management from the codebase, enabling faster development cycles, continuous integration, and multiple parallel projects within a given timeframe.
- **Site Deployment and Management:** Deployed sites on Netlify, configured CMS integrations, fixed DNS errors, and monitored performance and error status on live websites.
- **DNS Configuration:** Configured DNS settings and domain names for custom-hosted websites, enabling secure HTTPS connections and seamless redirects from HTTP to HTTPS.
- **Cloud-Based CMS Migration:** Pushed for migration of developed websites to a cloud-based CMS via GitHub, enabling seamless continuous deployment and automated website updates, eliminating the need for manual intervention by administrators.
- **Custom CMS Development:** Built a CMS for website administrators that separated website content from code, allowing administrators to update post titles, body content, and images without changing application code.

- **In-House CMS Development:** Made changes to an in-house CMS application using PHP, AJAX, and JavaScript for websites not using a cloud CMS.
- **Task Management:** Used task management software to track project timelines, define requirements, build mockups for client feedback, and communicate with managers about challenges.

Promasidor GH Ltd

June 2019 – August 2019

Intern

Accra, Ghana

- Assisted network professionals in the IT department with troubleshooting on switches and routers.
- Provided hardware and software support to employees and enrolled new users onto the company network in factory and corporate spaces.

Inlaks GH Ltd

June 2018 – August 2018

Intern

Accra, Ghana

- Assisted engineers to conduct maintenance and install applications on ATMs across banks.
- Tested hardware modules and sensors on new and existing ATMs.
- Troubleshoot problems with faulty ATM modules such as keypads and sensors.

TECHNICAL SKILLS

Frontend: React.js, TypeScript, JavaScript (ES6+), HTML5, CSS3, GatsbyJS, PWAs, Performance Optimisation, Responsive Design

Backend and APIs: Node.js, PHP, Express.js, RESTful APIs, WebSockets, Ruby

CMS Platforms: DecapCMS (NetlifyCMS), SveltiaCMS, custom CMS backends; headless CMS architecture and content modelling

Machine Learning: Python, PyTorch, Keras, FastAI, Computer Vision, Model Deployment (Hugging Face, Google Cloud Vertex AI, AWS)

Cloud and DevOps: Google Cloud Platform (Vertex AI, BigQuery, Dataflow, Computer Vision), AWS, Netlify, Render, Hugging Face Spaces, CI/CD

Data and Analytics: BigQuery ML, Google Looker Studio, Data Visualisation, Air Quality Data Analysis, Satellite Image Processing

Embedded and IoT: C, C++, Raspberry Pi, Arduino, GSM Modules, Sensor Calibration

Languages: JavaScript, Python, Java, C++, C#, Ruby, Dart (Flutter), PHP, SQL

Tools and Practices: Git, GitHub, Test-Driven Development (TDD), Agile methodologies, Unity3D

LEADERSHIP EXPERIENCE

IoT Club - Carnegie Mellon University Africa

2022 – 2024

Club President

Kigali, Rwanda

- Led a team of 6 committee members to organise campus events enhancing student knowledge of IoT and embedded systems, fostering a culture of innovation and technological exploration.
- Orchestrated field trips to Zipline, a company pioneering autonomous drone delivery of medical supplies to remote areas of Rwanda, providing students with real-world exposure to cutting-edge IoT applications in humanitarian technology.
- Served as a technical advisor for student projects, offering expertise in data collection, GPS integration, and various microcontrollers, thereby supporting practical application of IoT concepts.

PROJECTS

Personal Website and Blog

Ongoing

Owner and Developer

rdjarbeng.com

- Personal website and technical blog built with Ruby-Jekyll and SveltiaCMS, a headless CMS integrated with GitHub for content management and continuous deployment.
- Chose Jekyll as a learn-by-doing project, building the blog whilst simultaneously learning Ruby, inspired by Jeremy Howard of fastAI.
- Crossed 10,000 pageviews as tracked by Cloudflare analytics.
- *Technologies:* Ruby, Jekyll, SveltiaCMS, Git, CI/CD | github.com/RDjarbeng/rdjarbeng.github.io

Background Remover

August 2024

Machine Learning Engineer

[Hugging Face Space](#)

- Built out of frustration at the lack of a free, HD-quality background removal tool; implemented in a single Python file using Gradio and the `rembg` library.
- Supports multiple model architectures (U-Net, ISNet, Silueta) to cover different workflows, with options for solid-colour or transparent backgrounds, alpha matting, post-processing mask, and mask-only output.
- Exports PNG or WEBP in full HD at no cost, unlike most competing tools that require payment for HD downloads.
- *Technologies: Python, Gradio, Computer Vision, rembg, CI/CD*

Air Quality Analysis Dashboard

2023

Frontend Developer

[airanalysis.netlify.app](#)

- Interactive dashboard presenting PM2.5 and AQI data for Kigali city sourced from AirNow.gov reference monitors
- Includes monthly, daily, and hourly trend analysis, distribution characteristics, temporal pattern visualisations, and side-by-side comparisons of clean-air versus high-particulate days.
- *Technologies: React.js, TypeScript, Data Visualisation, JavaScript*

Lyrics Generator for Web

2023

Frontend Developer

[videolyrics.netlify.app](#)

- Browser-based tool to create animated poems and lyric videos instantly, built with React.js.
- Includes native device Text-to-Speech (TTS) via the Web Speech API for audio playback.
- Originally built for a friend who writes poems, enabling quick video generation without external tools.
- *Technologies: React.js, JavaScript, Web Speech API, CI/CD | [GitHub](#)*

Interactive Face Animation

2023

Frontend Developer

[roboface.netlify.app](#)

- Playful React component that tracks the user's mouse and expresses emotions based on proximity and interaction; goes idle and looks bored after a period of inactivity.
- Self-initiated project inspired by a Human-Robot Interaction course at Carnegie Mellon University, building a virtual robot that responds as if alive rather than just studying the theory.
- *Technologies: React.js, JavaScript, Animation, CI/CD | [GitHub](#)*

Countdown Progressive Web Application (PWA)

December 2021

Project Owner and Lead Developer

[rcountdown.netlify.app](#)

- Started as a personal tool to count down to midnight; grew into a fully featured PWA with themes, dark/light mode, and a day-of-year counter after friends expressed interest.
- Built with plain HTML, CSS, and JavaScript with offline support and resource caching via service workers.
- Led user-centred design process, prioritising features based on user feedback; attracted 90+ pull requests and many resolved GitHub issues, serving as an introduction to open-source collaboration.
- Implemented responsive design, user data persistence, and social media sharing.
- *Technologies: JavaScript, HTML, CSS, PWAs, Git, CI/CD | [GitHub](#)*

Real-Time Taxi Fleet Management

2023

Data Engineer

Google Cloud

- Designed a streaming data pipeline using Google Cloud Dataflow and BigQuery to ingest and analyse real-time taxi data.
- Displayed live metrics on Looker Studio for operational monitoring.
- *Technologies: Google Cloud Dataflow, BigQuery, Looker Studio, Streaming Data*

Predicting Loan Risk

2023

Machine Learning Engineer

Google Cloud Vertex AI

- Built and deployed a loan default risk prediction model using Google Cloud Vertex AI AutoML, with rigorous feature engineering and model evaluation.
- *Technologies: Google Cloud Vertex AI, AutoML, Python, Feature Engineering*

E-commerce Purchase Prediction

2023

Data Analyst

BigQuery ML

- Leveraged BigQuery ML to predict customer purchase behaviour, improving marketing ROI by 9x through targeted analysis of first-time visitors.

- *Technologies: BigQuery ML, SQL, Data Analysis*

Rwanda Energy Calculator

2025

Developer

rwanda-energy-calculator.netlify.app/

- Collaborated with developer Ian Akotey to build a static web app that accurately converts between Rwandan Francs and kWh using REG's tiered tariff system.
- Created a household estimator and usage tracker so users can calculate daily consumption and predict when their units will run out.
- Implemented a top-up feature to handle mid-month price changes, helping friends and locals easily budget their electricity.
- *Technologies: HTML, CSS, JavaScript, Python | [GitHub repository](#)*

GSM HTTP Requests

2023

Embedded Systems

[GitHub repository](#)

- Implementation of HTTP GET and POST requests using GSM modules in C++, a core component for remote IoT data transmission.
- *Technologies: C++, Embedded Systems, GSM, IoT*

Transmission Corridor Monitoring using Satellite imagery and Google Earth Engine

2021

Remote Sensing

- Developed alternative methods of monitoring transmission corridors to prevent land encroachment using remote sensing with satellite data in Google Earth Engine for Ghana Grid power transmission company (GRIDCo).
- Utilized satellite monitoring implementation to build a change detection application using 10m resolution images composited from the Sentinel-2 satellites for a selected transmission corridor.
- Deployed the application as a Google Cloud web application that allowed engineers to monitor a corridor for changes remotely by selecting towers of interest in the pilot area
- *Technologies: Google Earth Engine, CNN, Remote Sensing, Python*

YOLO-World Promptable Video Object Detection

2024

Computer Vision Engineer

[yolo-world-promptable-video-object-detection](#)

- Explored YOLO-World models for promptable object detection and segmentation on real-world video footage recorded in Kigali, Rwanda.
- Built a notebook-based demo to visualise detection and segmentation results, evaluating the model family for practical use cases.
- *Technologies: Python, YOLO-World, Computer Vision, Object Detection, Image Segmentation*

Web Crawler and Markdown Extractor

2024

Developer

github.com/RDjarbeng/crawl-tester

- Python tool that crawls a website and converts its content to Markdown, making it easy to analyse how search engines, AI agents, and bots perceive a site's structure.
- Supports localhost environments for testing local development sites before deployment.
- *Technologies: Python, Web Scraping, Markdown, CLI Tools*

IoT Security System

November 2022 – December 2022

IoT Engineer

- Engineered an IoT security system using Raspberry Pi, sensors, and Node.js for real-time monitoring.
- Implemented a WebSocket-based server for instant alerts and data visualisation.
- *Technologies: Node.js, Raspberry Pi, WebSockets, Real-time Systems*

University Application Management System

April 2020 – June 2020

Java Developer

[GitHub](#)

- Developed a desktop application to simplify the admission process for prospective students.
- Designed features for user registration, course and residence hall applications, and status tracking.
- Implemented an admissions dashboard for users and an administrator control panel for application management.
- Built with Java and JavaFX using OOP principles, utilising JDBC and SQL for database connectivity.
- *Technologies: SQL, Java, JavaFX, JDBC*

Job Search and Career Development Web Application

October 2018 – November 2018

Full Stack Developer

- Built a web application using HTML5, CSS, AJAX, and PHP to help employers discover students' skills ahead of graduation.
- Implemented messaging functionality for correspondence between employers and job seekers.
- Developed a cross-platform mobile app for user access from any device.
- *Technologies: PHP, AJAX, CSS, HTML5*

2D Game: Escape the Covid Maze

2020

Game Developer

- 2D game using Unity3D that challenges players to navigate a maze while avoiding Covid-19 blob villains that climb barriers and pursue the player.
- Implemented A* search algorithm to enable villains to strategically find the player in the maze, across two levels of increasing difficulty.
- *Technologies: C#, Unity3D, Pathfinding*

Machine Learning Complete

Ongoing

Open Source Contributor

[GitHub](#)

- Contributor to the Machine Learning Complete educational package, a comprehensive open-source resource for democratising AI education.
- *Technologies: Python, Machine Learning, Open Source*