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Salah Abdeljabar

IoT and Wireless Systems Engineer

Saudi Arabia | +966 544509259 | abdeljabar.net | salah.abdeljabar@kaust.edu.sa | linkedin.com/in/salahabdeljabar

PROFILE

IoT engineer with eight years of hands-on experience across the full stack: LoRaWAN and NB-IoT network design, RF characterization, embedded firmware, sensor integration and enterprise networking. I design and prototype systems that run outside the lab, from buried oil pipelines to port container yards. Recent work: a private LoRa localization system at **5 m accuracy** running for over a year on a battery, an underground oil pipe monitoring system built for *Saudi Aramco* across three ISM bands, a deep indoor NB-IoT system, and the network architecture for a 19 km hybrid FSO/RF link delivering 20 Gbps at 99.999% availability. Two years at Cisco TAC on enterprise routing and switching.

TECHNICAL SKILLS

LoRa & LoRaWAN: LoRa, LoRaWAN, LoRa ranging and round-trip time-of-flight localization, Semtech LR2021, ChirpStack, LoRaWAN Gateway Mesh, Meshtastic, sub-GHz and 2.4 GHz ISM, spreading factor and bandwidth tuning, LoRaWAN end devices, over-the-air activation, Class A/B/C, join and coverage evaluation.
Cellular & LPWAN IoT: NB-IoT, Quectel BG95, QuecPython, 433 / 450 / 868 MHz ISM band planning, RF characterization, link budget analysis, RSSI/SNR field measurement, spectrum and regulatory constraints, network attach and power profiling, buried and underground radio propagation.
Embedded & Firmware: ESP32, Arduino, C/C++ firmware, Quectel BG95, QuecPython, GPIO, ADC, PWM, interrupts and non-blocking timers, UART/I2C/SPI, one-wire sensor protocols, GNSS modules, deep sleep and low-power design, sensor integration.
Networking & Infrastructure: Cisco IOS-XE, Catalyst 9000 / IE / CDB series, enterprise routing and switching, VLAN segmentation, RSTP, QoS, link aggregation, sub-second failover design, network security (encrypted tunnels, firewall policy, access control), MQTT, CoAP, HTTP/REST, ThingsBoard, Ubidots, CCNA certified, Free-Space Optics (FSO), Wi-Fi, BLE, delay-tolerant networking (DTN).
System Design & Prototyping: end-to-end IoT architecture, requirements and stakeholder management, breadboard and field prototyping, weatherproof enclosures, solar and battery off-grid power, test design and instrumentation, measurement campaigns, troubleshooting from baseband to application layer, technical documentation, embedded machine learning (TinyML) for on-device inference and sensor fusion.
Software & Data: C/C++, Python, MATLAB, SQL (PostgreSQL), Git/GitHub, Linux, Docker, stochastic modeling and simulation, TensorFlow, PyTorch, Edge Impulse, signal processing and channel equalization.
Languages: Arabic (native), English (advanced; IELTS 8, TOEFL iBT 100).

PROFESSIONAL EXPERIENCE

Graduate Research Engineer, Communication Theory Lab — Aug 2021 – Present
King Abdullah University of Science and Technology (KAUST) — *Thuwal, Saudi Arabia*

- **Lead the technical delivery of a private LoRa localization system**, now in its MVP stage with a port operator client: LoRa round-trip time-of-flight ranging on Semtech LR2021 chips across sub-GHz and 2.4 GHz ISM, with LoRa ranging and LoRaWAN data sharing one radio through an orchestration layer of my design. Built the machine learning solver behind the position estimate. Result: **5 m accuracy at kilometer scale**, over a year of battery life and **30+ deployed nodes**. IP filed jointly with KAUST.
- **Designed and implemented an underground oil pipe monitoring system** for a collaboration with *Saudi Aramco*: LoRaWAN at 868 MHz and 433 MHz plus NB-IoT at 450 MHz, carrying narrowband IoT traffic from sensors buried at 1, 2 and 3 m to above-ground gateways. Ran the RF characterization and soil propagation studies across soil properties and environmental parameters, and delivered use-case recommendations now under consideration for later Aramco deployments.
- **Architected and implemented a deep indoor NB-IoT system**, driving the constraints of power budget and signal availability in basements and shafts: firmware design and optimization for several Quectel BG95 modules under QuecPython, covering power profiling, sleep modes and network attach. Prototype complete.
- **Owned the network architecture** for a commercial hybrid FSO/RF link connecting Shabara Island to the mainland across 19 km of open water for *Red Sea Global*: redundant dual-link topology (20 Gbps FSO primary, 6 GHz 1 Gbps RF backup), VLAN segmentation, QoS, link aggregation and RSTP, plus encrypted tunnels and access control. Delivered **99.999% combined availability** over six months of live operation. Hardware partner: Taara (X, the moonshot factory).

- **Built and field-tested TV White Space IoT nodes** with *Microsoft Research* (Whisper project): integrated a full autonomous node (TVWS radio with Semtech LoRa/FSK front end tunable 150–960 MHz, Arduino Nano 33 BLE Sense, microSD logging, GNSS, omnidirectional antennas, off-grid power, weatherproof enclosure). Characterized links from 650 m NLOS at 915 MHz to **5–14 km at 177.6 MHz**, quantifying the effect of antenna height, modulation parameters and terrain.
- **Stood up a multi-gateway LoRaWAN Gateway Mesh testbed** (RAKwireless and ChirpStack), configuring relay and border gateway roles, time sync and channel plans, then measured packet delivery ratio, hop latency, coverage extension and gateway load against a single-hop baseline.
- **Designed and prototyped Super-LoRa**, a payload-superposition scheme that raises LoRa throughput by up to **5x**, implemented on USRP N210 and ADALM-PLUTO SDRs by extending an open-source GNU Radio LoRa physical layer and validated over a campus-wide campaign (1 km x 0.9 km, indoor and outdoor, LOS and NLOS). Published in *IEEE IoT Journal*.

Research Fellow, Marconi Lab Sep – Dec 2024 & Sep – Dec 2025
International Centre for Theoretical Physics (ICTP) *Trieste, Italy*

- Designed and implemented an energy-efficient off-grid wireless network based on **LoRa Mesh**, targeting deployments with no grid power and no backhaul.
- Supervised a visiting fellow whose work produced **LoRa QTree**, a new open-source LoRa mesh routing protocol.

Technical Consulting Engineer (Cisco TAC) Jun 2019 – Jul 2021
ESTARTA Solutions (Cisco Systems) *Amman, Jordan & Kraków, Poland*

- Resolved high-impact enterprise networking cases for Cisco's worldwide partners and customers, covering hardware faults, software defects and network design under production-outage pressure.
- Specialized in enterprise **routing and switching** on Cisco IOS-XE and the Catalyst 9000, IE and CDB families: spanning tree, VLANs, QoS, high availability, licensing and platform-level troubleshooting.
- Earned **CCNA Routing and Switching** certification during the role.

Instructor, Course Designer & Technical Mentor Jan 2023 – Present
KAUST Academy, KAUST and ICTP *Thuwal, Saudi Arabia & Trieste, Italy*

- **Main instructor and curriculum designer** for a five-day hands-on IoT course (KGSP Summer Enrichment Program 2026): built the curriculum, five slide decks and a **14-project ESP32 hub** with wiring guides and ready-to-flash sketches, and led a team of two teaching assistants.
- **Mentored and technically supervised 10+ students and interns** across LoRa mesh testbeds, LoRaWAN gateway mesh experiments, DTN platforms and applied AI projects.

EDUCATION

King Abdullah University of Science and Technology (KAUST) Thuwal, Saudi Arabia
PhD in Electrical and Computer Engineering, Advisor: Prof. Mohamed-Slim Alouini *May 2023 – Present*

- Thesis: Towards Global Connectivity for Devices and People.

King Abdullah University of Science and Technology (KAUST) Thuwal, Saudi Arabia
MS in Electrical and Computer Engineering, GPA 3.95/4.0 *Aug 2021 – May 2023*

The University of Jordan Amman, Jordan
BSc in Electrical Engineering (ABET accredited), GPA 3.95/4.0 ***(ranked 1st in cohort)*** *Sep 2014 – Jun 2019*

- Erasmus exchange semester at **Lund University**, Sweden (Aug 2017 – Jan 2018): Digital Communications, Antenna Technology, Digital IC Design.

SELECTED AWARDS AND RECOGNITION

Saudi Aramco Digital Hackathon, Second Place (Advanced Sensing, IoT & Robotics) Jan 2026
IEEE ICC Four Minute Thesis Competition, Second Place, Montreal, Canada Jun 2025
ICTP-Arab Fund PhD Fellowship, Trieste, Italy Sep 2024 – Dec 2026
6G Summit "Imagining Tomorrow" Video Competition Winner, Thuwal, Saudi Arabia Nov 2025
Ranked 1st among all Electrical Engineering graduates, The University of Jordan Jun 2019

SELECTED PUBLICATIONS

- **S. Abdeljabar** and M.-S. Alouini, *"Super-LoRa: Enhancing LoRa Throughput via Payload Superposition,"* IEEE Internet of Things Journal, 2025. **Link**
- F. S. Alqurashi, **S. Abdeljabar**, A. Trichili, and M.-S. Alouini, *"Overcoming Maritime Connectivity Challenges with Hybrid RF/FSO Links,"* IEEE Globecom Workshops, 2024. **Link**
- **S. Abdeljabar** and M.-S. Alouini, *"Bridging the Educational Divide: A Delay-Tolerant Networking Approach for Equitable Digital Learning in Rural Areas,"* IEEE Technology and Society Magazine, 2026. **Link**