

PhD Firmware Engineer | Multi-Disciplinary Expert in Comms, Embedded Systems & Tech Solutions

I like everything tech related, but especially system-design, comms, and coding, and I'm good at it. My skill set can be best described "*jack of all trades, master of none, still better than one*". I learn & adapt fast. Relevantly, I love sharing ideas & knowledge. I'm mainly enthusiastic about space, aviation & related technologies. Apart from my work, these days I'm passionate about cycling & skiing.

Education

PhD. Radar Signal Processing, Microwave Integrated Systems Laboratory, University of Birmingham, UK	10/2013 – 9/2017
MSc. Embedded Systems Design, KTH Royal Institute of Technology, Stockholm, SWEDEN	8/2010 - 5/2013
BSc. Honours Electronics Engineering, Bilkent University, Ankara, TURKEY	8/2006 - 6/2010
Middle East Technical University Development Foundation Private High School, Ankara, TURKEY	8/2003 - 6/2006

Work Experience

MTS (Staff) Firmware Engineer, [AMD AECG Group \(former Xilinx\)](#), Cambridge, UK 5/2022 – Present

Studying new IPs via documentation or via RTL; designing and implementing HW abstraction and then driver layers; bridging host driver APIs with the FW. Test and verification of pre-silicon RTL for bug hunting & fixing and/or reporting HW bugs.

Documentation of findings as verified hardware and firmware behaviour. Further efforts in supporting my team by software modelling the HW; setting up automated test infrastructures; designing the roadmap for larger blocks of FW, communicating necessary steps with management and sometimes allocating tasks to other engineers. Making architectural change proposals and implementing as time allows; and finally mentoring juniors, seniors and interns. I'm also one of the go-to persons when an issue needs urgent attention ("firefighting").

Embedded Software Developer, [Dekunu Technologies](#), NSW, Australia – REMOTE from Ankara, TURKEY 11/2020 – 4/2022

Design, development and coding of Dekunu ONE smart altimeter's baremetal firmware on an ARM based modern microcontroller. Assessment of issues reported by users and bug reporting. Continuous testing and improvement of codebase. Documentation of existing and new components of the codebase. Working remotely from Ankara, Turkey.

Part-Time Instructor, [Bilkent University](#), Ankara, TURKEY 6/2019 – 01/2022

Acting Module Coordinator/Designer and Instructor for *CS431 Embedded Systems*. Instructor for *CS223 Digital Design*. Also taught *Ceng232 Logic Design* at [Middle East Technical University](#) during Spring 2020 term.

Technical Lead, [Novit.AI](#), Ankara, TURKEY/London, UK 2/2019 – 9/2020

Development of machine learning systems, processing data from spaceborne SAR and multispectral instruments, continuous integration and deployment, embedded development, novel mesh networking methodologies, system design, project planning and management with direct report, management of a software dev team of 3, client engagement.

Research Fellow, [Microwave Integrated Systems Laboratory \(MISL\)](#), Birmingham, UK 9/2016-12/2018

Development of radar systems, hardware design & implementation, signal processing algorithm development, modelling & simulation, planning & conducting trials, data processing, documentation & presentation of results to stakeholders, project planning & managing, and managing students

Projects

AMD/Xilinx Network Accelerator Cards ([AMD/Xilinx SmartNICs](#)) 5/2022 – Present

Management controller firmware engineering of network accelerator cards which handle offloading of physical or virtual network interfaces off from a host CPU. I got involved with HW verification on Siemens Veloce, QEMU and a homebrew SW model; bug/signal tracing & reporting. I've developed FW drivers on RiscV, MicroBlaze and ARM with Zephyr for new&existing cards. Host-facing (kernel) driver API implementation based on a homebrew RPC (remote-procedure-call) infrastructure built on UART and PCI. I've ported FW written on top of FreeRTOS to Zephyr. And particularly I've ported Zephyr OS to MicroBlaze. I've refactored our CMake build system to be similar to Zephyr's, set up Jenkins CI/CD using bash & python scripts all around.

Briefs of the previous generations: [smartnic](#), [low-latency](#), [X2](#)

AMD/Xilinx Network Accelerator Cards ([AMD/Xilinx SmartNICs](#)) 5/2022 – Present

Management controller firmware engineering of network accelerator cards which handle offloading of physical or virtual network interfaces off from a host CPU. I got involved with HW verification on Siemens Veloce, QEMU and a homebrew SW model; bug/signal tracing & reporting. I've developed FW drivers on RiscV, MicroBlaze and ARM with Zephyr for new&existing cards. Host-facing (kernel) driver API implementation based on a homebrew RPC (remote-procedure-call) infrastructure built on UART and PCI. I've ported FW written on top of FreeRTOS to Zephyr. And particularly I've ported Zephyr OS to MicroBlaze. I've

created a KConfig alike build system with pure CMake, set up Jenkins CI/CD using bash and python scripts all around.

Briefs of the previous generations: [smartnic](#), [low-latency](#), [X2](#)

Zephyr RTOS Microblaze Port ([Pull Request #53576 at Zephyr](#)) 6/2022 – Present

A WIP 32-bit Microblaze port for Zephyr RTOS. Currently, all tests pass with AMD/Xilinx's proprietary compiler toolchain. Current effort is focused on upstreaming compiler toolchain fixes to Zephyr's public toolchain.

Dekunu ONE – Smart Altimeter for Skydivers ([core features](#)) 11/2020 – 05/2022

A smart altimeter that logs altitude and GPS position and syncs to cloud while showing real-time altitude to its user. Working remotely with a team from UTC+3, +7 & +12 time zones. The main work is inspecting bug reports, C coding for hotfixes, bugfixes and new features into the Dekunu ONE device. I also develop device test firmware and necessary python PC scripts for testing automation and debug/emulation purposes. I also work closely with the operation managers to solve users' problems which may not require coding which also helps build a knowledge base for both users and operation managers.

Thermidor – Self-service temperature measurement kiosk with camera and logs 3/2020 – 9/2020

Designed the hardware and software architecture of the device basing its main software on an rPi and delegating temperature and distance sensor interfacing to an ESP32. Also integrated real-time face detection, for which I've developed cloud-based ML detection system on real-time video stream. Also developed the embedded software and its comms-stack with rPi. After deployment, I've also developed sensor filtering and calibration algorithms for less false-positives.

Shale Track – Spaceborne Shale Site Detection and Construction Timeline Tracking 12/2019 – 2/2020

This is a true team effort of modifying our codebase to do static object detection (e.g. Shale sites) and change-detection on these sites. We started this by forking Shlep's AI modules to detect Shale sites using optical satellite images and to track their progress on SAR images. The labelling tool I created for Shlep was modified for speed labelling of shale sites. Final product is a framework that can find the optimal satellite tiles for a set of areas, detect Shale sites on imagery, plot site "activity" based on past SAR images, and finally estimate dates for their operation timeline and generates an excel report.

Sonon – Geospatial Information Service for Verifying Marine Vessel Voyage History 9/2019 – 1/2020

I took the lead on this project making architectural decisions, along with doing most of the heavy-lifting in means of coding. I designed and implemented cost-efficient cache-based algorithms to reduce our costs for fetching AIS vessel location data from service providers. I then branched SHLEP's codebase to start the UI and later modified it regards to client needs. Finally, I join business meetings with Turkish Ministry of Customs and Trade to adopt their requirements firsthand.

SHLEP – Ship Location Extrapolator Project ([Skybase](#)) 3/2019 – 2/2020

I was the lead on this project deciding our technical direction with respect to business motives. I decided on our radar & optical satellite computer-vision algorithms, training data sources, machine learning models and our optimisation approaches. I first created and coded our post-processing algorithms for combining SAR images. Then I've successfully designed and coded data fusion algorithms to automate labelling of images of oil tankers. I've also created a geospatial labelling software specialised for labelling large satellite images which we planned to open source. I've then designed and lead our team to implement our ML pipeline to detect, localise and classify oil tankers in both SAR and optical images with >95% accuracy. Goal is a B2B product that can detect & classify oil tankers in key areas with maximum 4-day intervals.

Edge AI Comms Unit – Multi-spectrum Comms Module for Edge AI Unit 2/2019 - 5/2019

I landed on the final stage of this project that utilised an ESP32 board with its micropython, LoRa and Wifi capabilities to deliver data from client's Edge AI unit to an MQTT server via a dual-layer mesh network. The unit is an rPi with a LoPy4 custom hat; rPi handled comms with AI unit and acted as cold storage while LoPy4 handled the multi-channel comms stack. I fixed the bugs and corrected the design faults in the project while directly engaging with the client and managing their requirements. I delivered the project to its finalised deployment ready state. I also optimised the latency-per-hop by 50% while implementing a per-hop reliable transport protocol. We implemented the entirety of the solution using Python.

PASSAT II - Passive micro-satellite based Spaceborne Synthetic Aperture Radar (SAR) 9/2017 - 12/2018

Planned and conducted ground and airborne trials and made the first breakthrough in the data processing. Flew on airborne trials to collect data, which I then performed offline processing to obtain SAR images. I've improved the performance of our processing via code optimisation and algorithm improvements and halved processing time. I also overtook the repackaging of our equipment and slashed half the size. Also achieved to define arbitrary geodetic coordinate grids for processing which allowed better comparison of measurements with ground truth. While also shadow-supervising a PhD student, I documented and presented our findings to the stakeholders on a quarterly basis (Uni of Surrey, UK DSTL).

SIMITAR II - Persistent surveillance from air with a low frequency MIMO towed array radar 9/2016 - 6/2017
Successfully developed beamforming algorithms for correcting tow-deviations. Then took the algorithm further ahead with Doppler processing for moving target indicators and also achieved per-beam platform motion compensation for enhanced target localisation. I planned and conducted lab and outdoor trials for algorithm verification with a 4x4 and a 4x16 TDMI MIMO. As an output I've documented and presented the outcomes to the stakeholders (QinetiQ/Airbus, UK DSTL).

MIMO Sensor Array Optimisation for Short-Range High-Resolution Automotive Sensing 10/2013 - 6/2016
I built a MIMO array radar with only an oscilloscope, a waveform generator and simple RF components. I conducted experiments to verify MIMO radar theory and developed a near-field MIMO beamforming algorithm which worked until proximities of 20cm where far-field starts at 2.5m. I then built an ultrasonic MIMO sonar from scratch. I designed and built transmitter and receiver PCBs and 3D printed a housing. I have then implemented heuristic optimization algorithms to obtain better beamwidths out of MIMO arrays and achieved 35% improvement on a 4x4 array. In the meantime, I have quarterly documented my progress and presented my work to stakeholders (Jaguar Land Rover).

Centralised Swarm AI system for MavLink enabled Unmanned Vehicles 6/2012 - 9/2013
I have been the technical manager for this project and therefore did the entire development plan and distributed tasks to the rest of the team. I oversaw the built of drones and conducted initial flight trials. I have integrated small Linux computers (rPi) onto quadcopters and interfaced them through serial port. I have written the drone software and the centralised command-line client in python. Finally, I successfully ran software-in-loop simulations of a 3-drone system using virtual machines and demonstrated our product to stakeholders (Turkish Ministry of Industry and Science).

VHF/UHF Uplink Solutions for Remote Wireless Sensor Networks 2/2012-12/2012
As part of my MSc, I have implemented IP over radio modems with complete protocol stack layers implementing TFTP/UDP/IP over [802.15.4|AX.25]. I have implemented this solution with C for a Linux machine, and ported it for ContikiOS. I designed PCBs for the radio modems and built a final solution with plug-and-play functionality. I've also tested the system in field and confirmed working with 2km range with 800 bits/s data-rate. I've released all the output on GitHub for WSN community to use.

Remote Pipe Observation System 6/2011 - 9/2011
I have designed a bespoke IoT embedded system capable of monitoring flow, pressure and temperature parameters of a pipe. As the lead in this project, I was also the point of contact for taking client's requirements and interpreting them into technical specifications and giving updates. I also chose the sensors and microcontrollers to be used and tasked a hardware specialist to assemble it on a PCB and build. I have successfully implemented the embedded firmware using mBed and developed PC software using Java which communicated with the device via a REST API over Ethernet.

Technical Experience (in no particular order)

Remote Sensing: MIMO Radar, Phased Array, Digital Beamforming, SAR, MTI, Doppler, Passive Bistatic, Airborne and Spaceborne, Sonar, Ultrasonic Sensing, Signal Processing, RF front-end, Automotive, Surveillance, Defence

Embedded Systems: Embedded software, Multi-core programming, FPGA programming, Low-level communications (RS232, I2C, Ethernet etc.), Wireless Sensor Networks, Network Applications, Client/Server programming, IoT (Internet of Things), STM32Cube, CMSIS, Zephyr, FreeRTOS, ugfx, ESP32, ublox, micropython, uC/OS, TinyOS, Contiki-OS, PCB design

Other: System Design, Algorithm Development, Heuristics, Machine Learning, Software Optimisation, Software Development, Project Planning and Management, Knowledge Transfer, Risk Assessment, Time Management

Languages: C, CMake, Python, MATLAB, Java/Groovy, VHDL, SystemVerilog, Bash, Assembly, HTML, CSS, Javascript

Environments: MATLAB, NI LabView, Keil, Git, Linux, Eclipse, Quartus, Xilinx ISE, Modelsim, Gpl-Eda, Netbeans, Proteus

Publications

[Improved Passive SAR Imaging With DVB-T Transmissions](#) 01/2020
[Reduced Redundancy Ultrasonic MIMO Arrays using Simulated Annealing & Genetic Algorithms](#) 12/2019
[Passive radar using Starlink transmissions: A theoretical study](#) 12/2018
[Passive SAR satellite constellation for near-persistent earth observation: Prospects and issues](#) 12/2018
[Passive SAR Satellite System \(PASSAT\): airborne demonstrator and first results](#) 10/2018
[Passive SAR Satellite System \(PASSAT\): Ground Trials](#) 08/2018
[MIMO Array for Short-Range, High-Resolution Automotive Sensing](#) 07/2018
[MIMO sensor array for short-range high-resolution automotive sensing, PhD. Thesis](#) 09/2017

Alp Sayin
Cambridge, UK

<https://www.linkedin.com/in/alpsayin>
<https://github.com/alpsayin>

alpsayin [at] gmail [dot] com
+44 776 141 7117

[MIMO Radar Concept with a Towed Antenna Array](#)

10/2016

[VHF/UHF Uplink Solutions for Remote Wireless Sensor Networks, MSc. Thesis](#)

05/2013

Teaching Experience

Supervisor for Concurrent & Distributed Systems & CompNet , Robinson College , Cambridge University	10/2022 – 4/2023
Module Coordinator and Instructor for CS431 Embedded Systems , Bilkent University	6/2019 – 1/2022
Instructor for Ceng232 Logic Design , Middle East Technical University	1/2020 - 7/2020
Instructor for CS223 Digital Design , Bilkent University	9/2019 – 6/2021
3xBSc Final Project, 3xMSc and 1xPhD “shadow supervisor”, University of Birmingham	3/2018 – 9/2018
TA for “Communication Systems”, “Computer Systems”, “Computing Systems & C Programming”, “Computer Networking”, “Circuits, Devices & Fields” modules, University of Birmingham	1/2014 - 6/2018
Team Coach for Communications System Design 2012 Fall Project, KTH Royal Institute of Technology	8/2012 - 1/2013
TA and private tutor for CS101(MATLAB), CS102(Java) and EEE212(Assembly) at Bilkent University	8/2008 - 6/2010
Volunteer English teacher in Southeast Turkey to local entrepreneurs organized by Bilkent Uni MAN dept.	8/2007

Other

Jumped out of a perfectly good Casa CN-235 and an Antonov AN-2	2019, 2023
Finished Bosphorus Cross-Continental Swimming Race in top 10 percentile in Istanbul, Turkey	2016, 2019, 2020
Finished and probably came last in BUCS Duathlon and BUCS Olympic Triathlon	2016, 2017
Committee Member and Advisor for University of Birmingham Skydiving Society	10/2016 – 1/2019
Trained with the University of Birmingham Triathlon Team & Swimming Team	9/2016 – 9/2018
58 th /700 at <i>ieeEXtreme</i> worldwide 24-hour programming contest	10/2009
Languages: Turkish (Native), English (Bilingual)	