Mohammad Abdi
Electrical and Computer Engineering PhD Candidate

🏛 ECE Department, College of Engineering, Northeastern University, Boston, MA, USA
🏢 Graduate Research Assistant at the Institute for the Wireless Internet of Things
⚗ MENTIS Laboratory
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ℹ Born on March 31, 1994 in Shiraz, Fars, Iran

⚡ Objective

My current research is focused on Efficient AI enabling the deployment of ML models to resource-constrained IoT devices using acceleration and hardware-aware techniques, Edge Computing where devices collaboratively execute a distributed task, and utilizing Dynamic Neural Networks to cope with mobile communication environments.

★ Research Interests

> Artificial Intelligence/Machine Learning
> Communication Systems/Signal Processing
> Embedded and Cyber-Physical Systems/IoT
> Robotics and Control/Optimization
> Software Development
> Quantum Information and Computation

🎓 Education

2022 - Present	Ph.D. in Computer Engineering, Northeastern University, Boston, MA, United States
	> Concentration: Communications, Control, and Signal Processing
	> Advisor: Prof. Francesco Restuccia
2016 - 2019	M.Sc. in Electrical and Computer Engineering - Communication Systems, Shiraz University, Shiraz, Iran
	> GPA: 18.27/20 (1st Rank)
	> Admitted as Exceptional Talent
	> Thesis Title: *Analysis, Design and Development of Doppler-shifted Interference Signal Cancellation Algorithms Using Adaptive Filters*
	> Advisor: Prof. Abbas Sheikhi, Prof. Mahmoud Farhang
2012 - 2016	B.Sc. in Electrical and Computer Engineering - Control, Shiraz University, Shiraz, Iran
	> GPA: 18.63/20 (1st Rank)
	> Project Title: *Time-Frequency Analysis of Signals with Spectrogram and Implementation of Various Audio Effects and a Graphic Equalizer with the C6416 DSK (TMS320C6416 DSP Starter Kit)*
	> Advisor: Prof. Mohammad Ali Masnadi-Shirazi
2008 - 2012	Shahid Dastgheib High School, Shiraz, Iran
	> GPA: 19.66/20
	> Affiliated with the *National Organization for Development of Exceptional Talents* (NODET)

🏆 Academic Achievements

> Ranked 1st among B.Sc. electrical engineering students admitted to Shiraz University in 2012
> Ranked 1st among M.Sc. electrical engineering students admitted to Shiraz University in 2016
> Exempted from M.Sc. entrance exam and admitted as talented graduate student to Shiraz University
> Member of *Exceptional Talents Community* at Shiraz University
> Manager of *Shiraz University Research and Entrepreneurship Center* (a.k.a *Radioamateury Lab*)
> Member and project manager at *Premier Ideas Support Center*

💻 Projets

SPACECRAFT SUN SENSOR   2016 - 2018
🔗 Iranian Space Research Center

Sun sensor is a navigational instrument used by spacecraft to detect the position of the sun. Sun sensors are used for attitude control, solar array pointing, gyro updating, and fail-safe recovery. In addition to spacecraft, sun sensors find use in ground-based weather stations and sun-tracking systems, and aerial vehicles including balloons and UAVs.

> Used STM32 as microcontroller for the commercial version and RPC56 (defence grade MCU for aerospace applications) for the aerospace version
> Made use of CCD linear image sensor (Toshiba TCD1304AP, TCD1205D and TAOS TSL1402) to locate the sun
> Took advantage of the microcontroller peripherals in an efficient way, which guaranteed the data acquisition and processing as fast as possible without involvement of the CPU
> Implementation of a communication protocol similar to that of the SS411 (NewSpace Systems Sun Sensor) over an RS-485 link
> Developed a GUI application with C# for Linux which plotted the data in real-time

`Signal Processing` `C++` `Keil` `Eclipse` `PowerPC` `SPC5 Studio` `Altium Designer` `Raspberry Pi` `C#`

Spacecraft Scanning Earth Horizon Sensor   2016 - 2018
🔗 Iranian Space Research Center

Scanning Earth horizon sensor uses a spinning mirror or prism and focuses a narrow beam of light onto a sensing element usually called a bolometer. The spinning causes the device to sweep out the area of a cone and electronics inside the sensor detect when the infrared signal from Earth is first received and then lost. The time between is used to determine Earth's width. From this the roll angle can be determined.

> Sinusoidal driving of three-phase permanent magnet motor (Gimbal Motor) for mirror rotation
> Reading inductive absolute angle encoder (Zettlex Midi IncOder) for measuring the angles in which the radiation from Earth is received and lost
> Using photodiode (Thorlabs FDS100) for the visibile light version and pyroelectric thermal detector (Gentec-EO QS2-IL and QS5-IL) for the infrared version in order to sense the intensity of light coming from Earth
> Development and implementation of an algorithm to utilize the features of the processor efficiently so as to filter the data and extract the information accurately
> Using a DNN to compute the spacecraft rotation about its principal axes using the data captured and labeled in a simulated environment

AI | Signal Conditioning | Altium Designer | C++ | Keil | IAR Embedded Workbench | BLDC Motor | C# | MATLAB | BeagleBone

C-Pay Parking Meter   2013 - 2015
🔗 C-Pay   🔗 Atishahr Hooshmand Iranian

A set of handheld devices for use in parking meter by parking enforcement officers (PEOs) is designed and built in order to collect revenues from cars based on the length of time they are parked in the controlled parking zones. These devices enable PEOs to read and write the RFID tags attached to windshields as if they are drivers' digital wallets or take photos from the vehicle license plate with the incorporated camera or enter the information manually. The collected data along with the vehicle's location are then transferred to the server and recorded in the memory card and a parking violation ticket is issued if necessary. The tags can be charged by another devices in corresponding kiosks which are capable of performing secure transactions using the bank SAM cards. These devices are now widely used in different cities in Iran.

> Using ARM® Cortex®-M4-based microcontroller (STMicroelectronics STM32F4 MCU series)
> Including a 3.2" TFT LCD touch screen
> Rendering the GUI forms according to the XML files in the memory card (GUI and settings can be changed easily in a way similar to Android programming)
> Authenticating/Reading/Writing RFID tags using NFC controller (NXP PN532)
> Determining vehicle geographic location by GPS Device (SIMCom SIM908)
> Sending encrypted data to the server with wireless module (ZigBee ZE10S and NRF)
> Logging all the information in memory card
> Getting image data from camera
> Printing parking violation ticket using the included printer
> Data entry using USB keyboard
> Performing secure bank transactions with clients' payment cards using a SAM card
> Adding extra features like USB mass storage mode, data synchronization using Ethernet, wireless firmware update and bootloader

Embedded Systems | Altium Designer | C++ | Eclipse | 32-bit ARM | Wireless Network | RFID | GPS | Camera | Printer | TFT LCD | SAM | XML

Luna Amusement Park Cashless Payment   2013 - 2015

A set of devices for making the ticketing system paperless is built which falls into 5 different categories:

1. CHARGER: These devices enable the workers to increase the clients' credit in exchange for cash. They are also capable of issuing new credit cards.
2. DISCHARGER: These portable and interchangeable devices are to be installed in different amusement rides and games. They sync all the transactions with the server as well as writing the contactless cards and tags offline.
3. DISPLAY: These devices show the clients their credit.
4. REPEATER: These devices are responsible for preventing network failure.
5. SERVER: All the transactions are tracked by the server. It can also set preferential prices (The pricing is dynamic and modifiable at all times, automatically or not).

Noting that the features of these devices are kind of similar to that of *C-Pay Parking Meter* devices and the only difference is in the scenario, in order for the transition from one project to another to be fairly easy, the firmwares and programs are developed subtly.

Embedded Systems | Altium Designer | C++ | ARM Cortex-M | Wireless Network | NFC | Printer | TFT LCD | USB Host | USB Device | Ethernet

MeyGol Production Efficiency Booster
<div align="right">2014 - 2017</div>

While all the sensors and actuators in a mushroom farm are being monitored and controlled by means of industrial automation tools such as PLCs and HMIs, the controllers are interconnected to make up an industrial network within which the server is responsible for recording all the parameters in the database and finding the correlation between these measurements and the quantity and quality of the products entered by a data entry clerk (using both classic and modern methods) and further using this feedback from observations to send proper commands to the PLCs. Furthermore, the client app enables its users to monitor and change the parameters through the Internet.

> Utilizing Microsoft SQL Server for recording the data
> Using Modbus TCP to send commands to the PLCs
> Programming the PLCs and HMIs with ladder logic and macros
> Using Microsoft Office Interop to generate graphical reports in Excel

`Machine Learning` `Software Development` `C#` `C++` `Ladder Logic` `Microsoft SQL Server` `Android` `PLC` `Network` `Industrial Ethernet`

Intelligent Walker
<div align="right">2014 - 2016</div>

A walker is designed to assist the elderly by using various sensors such as strain gauges and force sensors installed on the handles and a Kinect. It can adapt to the specific assistance requirements of the user by means of a model based on interpretation of the information provided by the sensors.

> Model training and system identification based on the data from sensors and motion capture using both active and passive markers
> Using Kinect to find and track the user's skeleton
> Controlling motors so as to minimize the interaction force between walker and user and control braking after detection of possible falls
> Sending the user's state if requested using GSM module

`Image Processing` `Robotics and Control` `C#` `C++` `MATLAB` `GSM`

💼 TEACHING & PROFESSIONAL EXPERIENCE

Present December 2015	**Project Manager | Developer, IRANIAN SPACE RESEARCH CENTER, Iran** > Design and construction of a sun sensor which meets the highest standards for reliability and performance in harsh environments > Building an Earth horizon sensor and developing an accurate processing algorithm > Debugging and testing the sensors in the simulated environments > Support and technical supervision of the development teams `AI` `Embedded Systems` `Signal Processing`
September 2015 October 2013	**Hardware Team Manager, ATISHAHR, Iran** > Design and build a portable embedded device with various modules > Design and development of an Android app > Providing support and delivering bug fixes `Board Design` `Embedded Software` `Signal Processing` `Android Software Development`

Teaching Assistant, SHIRAZ UNIVERSITY, Iran

Spring 2018	> Advanced Communication Theory, DR. MAHMOUD FARHANG
Spring 2016	> Communication Systems, DR. ABBAS SHEIKHI
Fall 2015	> Principles of Microcomputers, DR. NAVID YASREBI
Fall 2015	> Engineering Mathematics, DR. MARYAM DEHGHANI
Spring 2015	> Signals and Systems, DR. MAHMOOD KARIMI
Fall 2014	> Signals and Systems, DR. MAHMOOD KARIMI

Instructor, SHIRAZ UNIVERSITY, Iran

Spring 2018	> Computer-Aided Control Systems Design, SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING
Summer 2014	> Introduction to Electronics and Digital Circuits, ELECTRICAL ENGINEERING SCIENTIFIC ASSOCIATION
Fall 2013	> Embedded Systems, IEEE SHIRAZ UNIVERSITY STUDENT BRANCH

☰ Skills

Programming	C, C++, Microsoft .Net (**C#**, VB, ASP), **Java**, **Python**, **Verilog**, HTML CSS, **Ladder logic**, SQL, x86 and AVR8 Assembly
Softwares	MATLAB (+ Simulink), **Altium Designer**, **LabVIEW**, NI Multisim, OrCAD PSpice
Database Management Systems	Microsoft SQL Server, MySQL
Development Tools	Microsoft Visual Studio (+ Xamarin), Eclipse (SW4STM32, SPC5 Studio), **Keil**, IAR Embedded Workbench, CodeVisionAVR, **Code Composer Studio**, IntelliJ IDEA, **Android Studio**, Xilinx ISE
Operating Systems	Windows, Linux (**Ubuntu**, **Raspbian**, **BeagleBone Debian IoT**), Mac OS X, **Android**, **iOS**
AI/ML Libraries	PyTorch, TensorFlow
Other	LaTeX, Embedded Systems Design and Programming, DSP Programming, FPGA Programming, PLC Programming, Network Programming

👥 Research Experience

> Liu, Minghan, Diptashree Das, **Mohammad Abdi**, Francesco Restuccia, and Marvin Onabajo. "A Digitally Reconfigurable Low-Noise Amplifier with Robust Input Impedance for Machine Learning-Based Receiver Optimizations." In 2024 IEEE 67th International Midwest Symposium on Circuits and Systems (MWSCAS), pp. 392-396. IEEE, 2024.

> Das, Diptashree, **Mohammad Abdi**, Minghan Liu, Marvin Onabajo, and Francesco Restuccia. "Toward Wireless System and Circuit Co-Design for the Internet of Self-Adaptive Things." In 2024 IEEE International Symposium on Dynamic Spectrum Access Networks (DySPAN), pp. 540-547. IEEE, 2024.

> Zhang, Milin, **Mohammad Abdi**, Shahriar Rifat, and Francesco Restuccia. "Resilience of Entropy Model in Distributed Neural Networks." arXiv preprint arXiv:2403.00942 (2024).

> **Abdi, Mohammad**, Jonathan Ashdown, Kurt Turck, and Francesco Restuccia. "Channel-Adaptive Dynamic Neural Networks for Low-Complexity Distributed Signal Awareness." In MILCOM 2023-2023 IEEE Military Communications Conference (MILCOM), pp. 27-32. IEEE, 2023.

> Zhang, Milin, **Mohammad Abdi**, and Francesco Restuccia. "Adversarial Machine Learning in Latent Representations of Neural Networks." arXiv preprint arXiv:2309.17401 (2023).

> Taghvaei, Sajjad, Ali Tavasoli, Navid Feizi, Zahra Rajestari, and **Mohammad Abdi**. "A control-oriented dynamic model for sit-to-stand motion with fixed support." Proceedings of the Institution of Mechanical Engineers, Part K: Journal of Multi-body Dynamics 232, no. 2 (2018): 265-273.

🌐 Language Skills

Persian ●●●●●
English ●●●●○

> **IELTS Band Score:** 7.5 (L: 8.5, R: 8.5, W: 6.5, S: 6.5)

➕ Strengths

> Passionate
> Motivated
> Independent

❝ References

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