Abdelaziz Wasfy Abdelaziz Shaarawy

Dorm no.1, Universitetskaya St, 1, Innopolis, Republic of Tatarstan, Russia
Email:
abdelazizshaarawy@gmail.com
a.shaarawy@innopolis.university
GitHub:
https://github.com/zizowasfy
Personal website:
https://zizowasfy.github.io/

Professional Profile

- Postgraduate student studying Robotics and Computer Vision at Innopolis University, Russia. I have spent my undergraduate and graduate years working on projects in the field of mechanical design, electronics, control, automation and robotics. Constantly appointed in technical hardware design and different manufacturing processes. Experienced in developing software programs that serve operational tasks. Acknowledged for showing persistence and teamwork towards assigned roles.

Education

- Current: Postgraduate Master student at Innopolis University, Russia. Enrolled in Robotics and Computer Vision program. Expected to graduate in August 2022.
- Graduated, with High Honors, from Nile University, Egypt in July 2020 with a bachelor's degree in Mechanical engineering, Mechatronics major.
- Bachelor's Courses studied: Analytical Geometry, Calculus I, Integration, differential equations, Physics I, Physics II (including Labs), Introduction to Engineering Disciplines, Engineering Design, Chemical Principles, Engineering Economy, Safety Engineering, Introduction to Programming, Engineering Mechanics (statics & dynamics), Natural Science, Numerical Methods, Introduction to Finite Elements techniques, Fluid Mechanics I, Solid Modelling, Manufacturing Technology, Rigid Body Dynamics, Metallurgy, Kinematics & Dynamics of Mechanical systems, Electronics & Power Circuits, Machine Design, Fundamentals of Mechatronics, Automatic Control, Modelling and Simulation, Mechanical Vibrations, Robotics, Pneumatics and Hydraulics of control systems, Digital & Industrial Control, Advanced Mechatronics, Microcontrollers, Signal processing.
- Bachelor's CGPA: 3.73/4.0
- Master's Courses studied: Dynamics of Non-Linear Robotics systems, Object Oriented Programming, Sensing-perception and Actuators, Machine Learning, Fundamentals of Robotics control, Advanced Robotics, Computer Vision, Optimization and Computational Intelligence, Behavioral and Cognitive Robotics.
- Master's CGPA: 4.2/5.0

Professional Experience

- [Feb 2017 – May 2017] Teaching Assistant (TA) for an undergraduate course 'Mechanics and Dynamics' at Nile University.

- [September 2017 – March 2020] FESTO professional Diploma in Industrial Automation & Mechatronics. Courses studied:
    - Fluidics (Pneumatics ~ Electro-Pneumatics ~ Hydraulics)
    - CNC (Milling, lathing)
    - Electrical Drives (DC & AC Drives)
    - Automation (Introduction & Advanced PLC programming)
    - Robotics (Kinematics & Robotics ~ Robotic Programming)

- [June 2018 - August 2019] Product designer and manufacturer, Engineering Op. Company:
  - Participated in manufacturing a Remotely Operated Vehicle (ROV) for a graduation project.
  - Involved in operating several manufacturing techniques and processes: Milling, Drilling, lathing, and different CNC operations.

- [August 2018 –July 2019] Participation in the Erasmus +KA2 VET-ENG project and achievement of Joint Project (NU – GBAUTO) program.
  - Design a 3D model of a 3D-printer using SOLIDWORKS software.
  - Designing the control box layout for the 3D-printer hardware.
  - Manufacturing and assembling of the 3D-printer parts.
  - Integrating the mechanical design and the electrical board.
  - Testing and developing for higher output accuracy.

- [July 2019 – November 2019] Embedded systems Diploma. Skills acquired:
  - C Programming and Data structures Algorithms
  - Embedded Systems Concepts
  - Embedded C for Microcontrollers
  - Embedded Systems Software Design Using UML
  - HW/SW Co-Design
  - Real Time Operating Systems and Scheduling
  - Software Engineering for Embedded Systems
  - Verification and Testing of Embedded Systems

- IEEE NUSB volunteer for 3 years. Helped in organizing a programing event called "Programabitious" hosted by IEEE NUSB that was of a great success.
- Participating in the international Robocon competition for the 2018 year as the Team leader of the mechanical team. Managed to design a manual robot with a forklift mechanism in addition to an automatic robot with a throwing mechanism.
- Machine Learning Winter School 2020 attendee. I had the chance to attend lectures from top world class professors and researchers from the field of my interest, Robotics and Machine Learning. Topics covered: Behavioral and Cognitive perception, Reinforcement Learning, and Deep Learning in Roboitcs.

Projects
- **My Master's Thesis** [ongoing] is dedicated to controlling robots where the human is being part of the control loop i.e., human-robot interaction. The hardware that I am developing with are Kuka LBR Iiwa 14, and Touch haptic device. Now, I am connecting to Iiwa robot through ROS interface which is running on Ubuntu 18, while the Touch is on C++ program which is running on Microsoft Visual Studio '17, Windows 10. With installing ROS on windows, I have the capability of connecting the Touch program to ROS, thus it has become applicable to connect the two robots within two nodes in a ROS master server connection; hence, a bilateral communication is established. From here, I made joint mapping as well as end-effector position mapping programs so that to have the Touch control the Iiwa in both joint and cartesian spaces. *please refer to the Video from here.

  With such teleoperation system, I am currently working on performing a Peg-In-Hole task where the user controls the position of the Iiwa, 'slave' manipulator, via the Touch, 'master' manipulator, while having continuous force-feedback from the Iiwa. I plan to perform the Peg-In-Hole task in different scenarios: 1) fully automated 2) fully teleoperated 3) shared (autonomous-teleoperated) 4) RL policy learned from

demonstration. The main objective with my thesis will be conducting a thorough comparison between these scenarios in terms of time take to complete the task, repeatability, scalability, and effort exerted (from the robot and the user).

- **My Bachelor's Thesis** had two scopes, controlling a Teleoperated custom-made 7 DOF serial arm manipulator hardware through VR, and controlling it via application of AI techniques. First, using ROS, we managed to import the robot's URDF model in ROS visualization environment, and through ROS's tools, we were able to perform motion planning and execution to defined points in the robot's workspace. Furthermore, Unity3D game engine was used as the platform for integrating VR kit (headset and controllers). After creating a scene in Unity, a ROS-Unity teleoperated connection is established through a local network with the use of ROS-Sharp libraries and tools. Hence, when the user puts on the VR kit, enters the scene, and moves the robot in the Unity scene, the motion of the robot is transferred to the robot's actual hardware body, thus making the same motion given by the user from the VR Unity scene.

  On the other hand, we designed our own deep neural network (DNN) for training the robot to cover its workspace and create its own model without the use of conventional Inverse kinematics method.

  I was mainly responsible for developing the hardware, parsing the URDF into ROS and Unity, motion planning and execution of the robot, and establishing the connection between ROS and all other platforms (nodes) used, Unity3D, Gazebo simulation tool, Keras-Python, and hardware's microcontroller.

  *please refer to the [Video from here](#)

- Tele-operation of a Cable-driven robot via Touch haptic device. I was appointed by my master's thesis supervisor to establish a communication schema between the two hardware robots. The Cable robot is running on a Golang program while the Touch is running on C++ program. So, I opened a websocket communication to have bi-lateral channel for sending/receiving data. Finally, the user can interactively control the velocity of the Cable robot from the Touch's workspace.

  *please refer to the [Video from here](#)

- Object detection of a peg using YOLOv5 and hole detection using HoughCircles for a PegInHole task performed by KUKA LBR Iiwa 14.

  *please refer to the [Video from here](#)

- Applying PD, Feedback linearization, and robust control techniques on a simulated PRR serial robot configuration using python and MATLAB.

- Participated in Machine learning competition held on CodaLab as a part of a course. I built a deep neural network model for classifying 9 classes of various types of animals and vehicles using CNNs and FC networks. I took the 4th place out of 43 participants.

- Designing and making a vertical XY plotter and applying image processing technique using MATLAB and Arduino for controlling.

- Implementing and controlling of a 6-DOF serial robotic arm using MATLAB and ARDUINO software.

- Simulation of a 4-DOF delta parallel robot via MSC Adams software and study analysis of its motions.

- Measuring the speed of fluid(air) using pressure differential sensor connected with a pitot tube kit and displaying the data on a LED screen using Arduino.

- Simulating the heat distribution on Earth and Mars' cores using COMSOL software.

- Solving ODEs and PDEs using Numerical Solutions; Finite Element techniques.

- Mathematical modeling of a mechanical based Seismograph using MATLAB.

- Designing an apparatus for illustrating Magnetism using AutoCAD.

- Memory Game using Python coding language.

| **Publications** | • K. Almaghout, R. A. Boby, M. Othman, A. Shaarawy, and A. Klimchik, "Robotic Pick and Assembly Using Deep Learning and Hybrid Vision/Force Control," in *2021 International Conference "Nonlinearity, Information and Robotics" (NIR)*, Aug. 2021, pp. 1–6. doi: 10.1109/NIR52917.2021.9666138. |

• H. A. Elkholy, A. S. Shahin, A. W. Shaarawy, H. Marzouk, and M. Elsamanty, "Solving Inverse Kinematics of a 7-DOF Manipulator Using Convolutional Neural Network," in *Proceedings of the International Conference on Artificial Intelligence and Computer Vision (AICV2020)*, Springer Cham, 2020, pp. 343–352. doi: 10.1007/978-3-030-44289-7_32.

Achievements

• Awarded the 2nd place in the annual Research Forum in Nile University for the project entitled "Solving ODEs and PDEs using numerical solutions through finite element techniques"
• Awarded the 5th place in the DELL EMC Technologies annual challenge for graduation projects from senior undergraduate students, year 2020.
  Please refer to the project's video for more details:
  https://www.youtube.com/watch?v=oxwMDySRGDk
• Awarded the 1st place in graduation projects category at Egypt IOT & AI challenge competition 2020. Subsequently, our team got invited to attend and participate with presenting the project's idea in the IEEE GCAIoT 2020 Online Conference.

Technical Skills

• Robot Operating System (ROS) [I have worked (self-studied) with ROS for almost one academic year. I was nominated by my professor to give an introductory session about ROS to undergrad freshmen]. Since then, I work with ROS back in my bachelor's thesis and till now in my master's thesis. [3 years, very good level]
• MATLAB Tools [4 years, very good level]
• Python coding language [3 year, very good]
• Unity3D engine [moderate level]
• C++ coding language [1 year, very good level]
• Golang programming language [good level]
• C coding language [5 months embedded systems diploma]
• Arduino [3 years]
• SolidWorks: 3D CAD Design Software [3 years]
• Proteus Design Suite [1 year]

Linguistic Skills

• Arabic is my native language
• English: Academic IELTS Overall score (7.5/9); level (C1)
• Russian: elementary level
• I like learning new languages