Mohamed Rezk

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Education

2020 - present	**Ain Shams University,** Cairo, Egypt *Bachelor of Science in Electrical & Computer Engineering* Senior year 1 (4/5)	CGPA: 3.70 / 4.0	Anticipated Graduation : Jul 2025
Class 2020	**Dakahlia STEM School,** Gamasa, Egypt *High School Certificate* CGPA: 4.0 / 4.0 (1st Rank)

Experience

Oct 2023 - Present	**ASMARINE (Autonomous Underwater Vehicles team),** ASU *Software Engineer* Led by Eng. Samer Mansour • Implemented state-of-the-art algorithms in Computer Vision and SLAM. • Explored the feasibility of machine learning-based control in AUVs. • Optimized code for resource-constrained computers.
Jun - Sep 2023	**Human Centered Mechatronics Lab,** ASU Virtual Hospitals *Research Assistant* Supervised by Dr. Mohamed Awad • Implemented a TCP communication tunnel to retrieve data from various sensors through XML commands. • Synchronized motion capture cameras with the metabolic energy consumption system. • Automated sensor calibration process.
Mar 2023	**Cardiff University, School of Engineering,** Wales, UK *Visiting Student* Hosted by Dr. John McCrory Full ride program (UK-HE Climate Research Grant): • Cultural and educational exchange. • Conducted Fourier analysis and signal processing on composite structures. • Visited the Riverside community for sustainability and clean energy.
Aug - Oct 2022	**Center for Sound, Vibration & Smart Structures** Dynamical Systems & Digitalisation Cluster, Ain Shams University *Signal Processing & Optimization Intern* Supervised by Dr. Ahmed Hesham • Implemented an acoustic wave velocity algorithm within composites. • Analyzed raw sensor data to localize acoustic sources such as cracks. • Implemented optimization algorithms (particle swarm, simulated annealing, simplex method). Code / Report
Mar - Apr 2022	**CAMTECH CNC,** Maadi, Egypt *Programmatic Video Editor* Utilized FFmpeg for bulk conversion and employed DaVinci Resolve and Python to edit and create high-quality videos.

Articles

Jul 2023	**The Fifteen Puzzle** An article discussing the generalization and solvability of the fifteen puzzle and how to solve one if feasible using structured algorithmic techniques. I also implemented a dedicated solver to assist the article using weighted iterative deepening A* with some optimization under the hood. <u>Article</u> |<u>Code</u>
May 2022	**Diffusion Equation: A computational approach** An article discussing diffusion equation as a mathematical, and computational model. The article starts with introducing the math behind the physical model and tries to generalize the results to higher dimensions, taking into account the approximation nature of such a phenomenon. <u>Article</u>

Projects

Feb 2023	**Implementation of A* on Open Street Maps Data** An Implementation of A* algorithm with KDTree and KNN algorithms to compute shortest path on a open street maps data based on haversine heuristic and randomized median of medians algorithm to speed up KDTree formation. This algorithm is developed on top of an extended Kalman filter that runs on a bare-metal embedded microcontroller with a GPS & IMU. <u>Code</u>

Open-Source Contributions

Nov 2023	**automata-cli** A command-line interface program to render automata description in program-like form to a visual format, and also performing some algorithms on the automata structure like minimization and conversion to other forms.<u>Code</u>
Mar 2023	**bookmarks.sh** A bash script for saving and retrieving bookmarks globally on UNIX-like OSs based on demun software.<u>Code</u>
Feb 2023	**CV.py** A simple conversion of yaml file containing the CV information in a hierarchical order into a nice and elegant LaTeX file that is fed to an API for compilation. User does not need to know LaTeXsyntax nor have LaTeX compiler on his/her local machine. <u>Code</u>

Awards & Honors

2023	**NASA Space Apps Cairo,** *Most Innovative Solution & 25k Egyptian Pound Prize* My team and I were fortunate to receive the "Most Innovative Solution" award along with a prize of 25,000 Egyptian pounds at the NASA Space Apps competition. This competition featured approximately 150 teams from various disciplines. Our project focused on the unique concept of data sonification, with a particular emphasis on enhancing the perception of space imagery.
2022	**Summer of Math Exposition (SoME#2) | 3Blue1Brown** *Top 100 entries & Top 25 Articles* I secured a position within the top 100 participants at the Summer of Math Exposition (SoME#2), an event organized by Grant Sanderson (3Blue1Brown) and Leios Labs. Additionally, my entry received recognition as one of the top 25 non-video submissions, covering diverse categories such as articles and games. The competition focused on effectively presenting in-depth content in mathematics, computer science, and physics through engaging mediums, including articles, games, and other creative formats. <u>Article</u>

Hackathons & Competitions

Summer 2023 | **NASA Space Apps Cairo,** AUC
Developed a web application that transforms various types of space images, into not only audible sound but also harmonious music. I did the following:
• Implemented a melody fitting algorithm: aligning classical music pieces with the input image.
• Implemented a panoramic projection algorithm.
• Awarded "Most Innovative Solution" with 25k L.E Prize.

Summer 2022 | **NASA Space Apps Cairo,** AUC
• Developed a web interface for ISS 3D virtual tracking in realtime
• Implemented orbital propagator algorithm for International Space Station based on the laws of orbital mechanics and astronomical algorithms.
• Implemented a sun tracking algorithm for stallite solar panels.
• Awarded 500$ AWS Credit Points Prize. Code

Summer 2021 | **NASA Space Apps Cairo,** Virtual
• Created a web interface for simulating distant rotating Jupiter asteroids.
• Implemented a real-time light curves computation algorithm
• Utilized Blender's Python API to construct a simplified 3D solar system scene. The objective was to simulate approximate conditions an asteroid encounter for input into an algorithm. Code

2018 | **Egypt Robot Challenge**
Ideas Gym
- Silver Medal & Global nominee to China

Activities

2018 - 2020 | **Dakahlia STEM School**
Technical Support at Fab Lab Team
• Provided help for those who are not familiar with Fab Lab machines
• Gave a detailed background on Fab Lab policies and tools for newcomers and visitors.

2019 - 2020 | **Dakahlia STEM School**
Mentor at DK Counseling Club
• Provided students with adequate knowledge about efficient ways of learning and creating.
• Gave sessions and presentation about higher education options for school students.

2019 - 2020 | **Dakahlia STEM School**
Mentor at DK Robotics Club
• Helped students with their school projects and prototypes.

Programming Skills

Python	LaTeX	Octave
C/C++	Java	Programmatic animation
Bash scripting	Linux/UNIX	Lua

Languages

Arabic	English	German (Fit in Deutsch A1)