Muhammad Shayan Nazeer

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Research Interests: Network and System Design, Cloud Computing, 5G Mobile Networks, and 3GPP Standards.

Education

University of Massachusetts, Amherst, United States — Sept 2023 – Present
Ph.D. in Electrical and Computer Engineering

Thesis: Redesigning 5G control plane for correctness and scalability in cloud environment
Advisor: Dr. Taqi Raza

National University of Sciences and Technology (NUST), Pakistan — Sept 2019 – July 2023
Bachelor's of Electrical Engineering (Gold Medal)

Focus: Computer Networking, Embedded Systems, and Hardware Security

Experience

Graduate Research Assistant — *Sept 2023 – Present*
University of Massachusetts Amherst

- Developed a *distributed 5G core testbed* on the POWDER platform to evaluate performance under cloud-specific challenges.
- Redesigned 5G core by integrating a *vector clock* and *context aware* scheduler to ensure state consistency, improving throughput and latency by addressing issues like message reordering, delays, and collisions in a cloud-native 5G environment.
- Investigated functional correctness of 5G core cloud deployments, ensuring scalability and reliability for cloud-native systems.

Embedded Software Engineer (Internship) — *Apr 2021 – Oct 2021*
RADWI

- Designed and developed an IoT-enabled electronic door lock, integrating real-time connectivity with AWS IoT Core.
- Prototyped a Zigbee mesh network for enhanced connectivity of smart home automation devices.
- Led the development of a framework to integrate smart home devices with cloud and mobile application.

Technical Skills

5G Tools: Open5GS, Free5GC, UERANSIM, PacketRusher, POWDER Platform
Programming Languages: C++, C, Python, JavaScript
Cellular Networks: Network Systems Design, Cloud Native 5G, Cellular Core Architecture.
Engineering Tools: MATLAB, Quartus, Mbed Studio, Altium Designer

Honors and Awards

2017 **INTEL ISEF**, Finalist, National Level
2022 **CSAW Logic Locking Conquest**, Global Runner Up (Organized by New York University)
2023 **NUST High Achiever's Award**, Gold Medal
2023 **Rectors Gold Medal**, Best final year project

Projects

ORACLE

- Submitted to NSDI'25 (awaiting decision). Implemented a distributed 5G core with vector clocks and intelligent scheduling to deal with distributed system issues like race conditions, deadlocks, state inconsistencies, and similar. The goal is to redesign 5G core making it more suitable for cloud infrastructure.

Time Synchronization at 5G Edge:

- Enabled time synchronization using NTP protocol for IoT devices at the 5G edge.
- Used Nordic NB-IoT board (nrf9160) for prototyping and implementation.

Optimizing Federating Learning Efficiency in a 5G Network:

- Investigated Federated Learning performance in a 5G network.
- Optimized efficiency using delayed gradient averaging (DGA) to account for network latency.

MIPS Simulator With Tomasulo's Algorithm Implementation:

- Developed a MIPS simulator integrating Tomasulo's algorithm for dynamic instruction scheduling and execution, using Python.
- Additionally, designed an intuitive GUI to provide a visual representation of the simulation process.

FPGA Implementation of Bresenham Circle Drawing Algorithm:

- Implemented Bresenham's circle drawing algorithm in Verilog to draw circles of variable radii.
- Utilized University of Toronto's VGA adapter to display output on monitor using DE1-SoC FPGA.

Spoken Digit Recognition:

- Designed and implemented a robust model for spoken number recognition utilizing Mel-Frequency Cepstrum in MATLAB.
- Integrated MATLAB with a microphone to capture and store numerical data from speech, creating an efficient feature vector for accurately identifying numbers in audio clips.

Gender Bias Detection Among Search Engines (Google vs Bing vs DuckDuckGo):

- Created a dataset (images) of 10 different gender-neutral words from 3 mentioned search engines.
- Using a deep learning model, images were classified into male, female, and neutral classes.
- Then I statistically estimated the gender bias among search engines using percentage of classified images for each gender-neutral word.