

Yongkang Cheng

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EDUCATION

University of Toronto (St. George Campus), Toronto, ON Sep 2023 - May 2028 (expected)
Bachelor of Applied Science in Computer Engineering + PEY Co-op
Relevant Courses: Applied Fundamentals of Deep Learning, Software Design and Communication

TECHNICAL SKILLS

- **Programming:** Python, C/C++, Node JS, Java, Verilog, Assembly(RISC-V)
 - **Frameworks:** PyTorch, React, FastAPI, LangChain, MCP
 - **Tools:** Linux, SQL/NoSQL, Nginx, Docker, Git, SSH
 - **Hardware:** Arduino, Raspberry Pi, FPGA, LTSpice, Quartus, ModelSim, STM32
 - **Data and Visualization:** NumPy, Pandas, Matplotlib
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EXPERIENCE

Research Assistant, Ultra-Wideband Communication Systems (University of Toronto) Jun 2025 - Jul 2025

- Developed hybrid modulation techniques combining 2PPM and 8PSK for UWB communication systems, achieving 500Mbps symbol rate at 4GHz carrier frequency with 20dB SNR performance.
- Implemented complete signal processing pipeline using MATLAB Simulink and Python, including phase noise modeling, AWGN addition, and multi-stage sampling rate conversion (16GHz \rightarrow 1024GHz).
- Designed innovative demodulation algorithms using K-means clustering for automatic constellation calibration and template matching for precise pulse position detection.
- Achieved sub-150 μ s measurement precision through advanced edge detection algorithms and dynamic offset correction, processing terahertz-scale sampling data (1.024THz) for high-resolution signal analysis.
- Conducted comprehensive BER analysis and performance evaluation, generating 50MB+ of simulation data and establishing ground truth datasets for future UWB research.

Frontend Manager, Voluntrack.org (Non-Profit) | *React, Figma, MS Project* May 2024 - Present

- Led a 4-person team to redesign the web interface using React.js, improving user engagement by 20%.
 - Designed UI in Figma and managed tasks with GitHub Projects and MS Project.
 - Integrated Firebase for secure volunteer data storage and real-time search, allowing fuzzy search and filtering.
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PROJECTS

Project Lead, Handwritten Text Recognition (University of Toronto) Jun 2024 - Aug 2024

- Led a remote team to develop a PyTorch-based CRNN model for handwritten text recognition.
- Achieved 87% word-level and 95% character-level accuracy on the test set with 10,000+ samples.
- Deployed connected-pixel algorithms for word positioning and word segmentation, processing 1024 \times 1024 images in less than 4 seconds.

Core AI Developer, Wrong-Tree Unity Game Dec 2024 - Jan 2025

- Designed and implemented comprehensive NPC behavior system with 9-state finite state machine (Idle, Wander, Share, Steal, Flee, etc.) for intelligent agent interactions in Unity.
- Developed advanced AI decision-making algorithms based on proximity detection, attitude systems, and dynamic reputation scoring, enabling realistic NPC social behaviors.
- Created complex multi-NPC interaction framework with "securing" and "releasing" mechanisms, supporting simultaneous share/steal operations with visual feedback animations.
- Implemented dynamic lighting system with flickering effects and procedural light intensity management, integrating seamlessly with core game mechanics.
- Built modular utility systems including random walk algorithms, distance-based targeting, and state synchronization, resulting in scalable and maintainable codebase.

Project Manager, Wellness Room Expansion (University of Toronto) Jan 2024 - Apr 2024

- Led a cross-functional team of 6 students to redesign and prototype a wellness room, endorsed by the client.
- Streamlined task management using Microsoft Project, tracking over 100+ tasks to completion on schedule.

- Incorporating client feedback, generated 100+ initial ideas and finalized 3 proposed designs.
- Designed and visualized proposals using Rhino and Blender 3D models, reducing client feedback iterations and improving decision-making efficiency.
- Conducted research on noise isolation, light intensity, and light temperature to deliver optimal design solutions.

UTEK Wildfire Disaster Communication System

Jan 2025

- **Top 8 Finalist** in University of Toronto Engineering Competition (UTEK) among all competing teams.
- Built real-time communication platform with Python, Streamlit, and Flask for wildfire emergency response coordination.
- Implemented interactive map interface using Folium for visualizing fire incidents and location-based alerts.
- Developed bidirectional communication system between residents and rescue teams with photo upload capabilities.
- Created severity classification system with automated risk assessment for intelligent resource allocation.
- Designed secure authentication portal for authorized rescue personnel with role-based access control.

Fourier Epicycle Drawing Visualization System

May 2025

- Built an interactive Python/Pygame app to draw strokes and visualize their Fourier decomposition as animated epicycles in just 3 hours using the MCP (Model Context Protocol) technique.
- Implemented stroke preprocessing (merging, equidistant resampling) for accurate analysis.
- Animated rotating circles (epicycles) to demonstrate Fourier series reconstruction of closed curves.
- Developed modular utilities for stroke processing, Fourier transform, and Matplotlib-based plots.
- Designed extensible architecture for saving/loading, real-time adjustment, and multi-color support.
- Produced educational outputs and visualizations for teaching and presentations.

FPGA Polyphonic Synthesizer (DE1-SoC)

Mar 2025

- Implemented a 20-voice digital synthesizer in C for a Nios-V soft-core, streaming **8 kHz Q15 audio** through the on-chip Audio FIFO with <1 % CPU overhead.
- Replaced all floating-point math with **32-bit phase accumulators** and fixed-point kernels for sine, square, triangle, and sawtooth waves, enabling real-time mixing and envelope processing.
- Designed an **ADSR envelope engine** driven by slide-switch “knobs” and pushbuttons; state changes are visualized on a double-buffered 320 × 240 VGA UI.
- Integrated PS/2 keyboard interrupts for sub-μs latency note-on/off events; on-screen piano keys light up in sync with hardware playback.
- Built modular drawing primitives (Bresenham, bitmap blits) to render live waveforms and icons; architecture supports future effects or MIDI input with minimal refactor.

City Mapify – Interactive City Mapping Application (University of Toronto)

Jan 2025 - Apr 2025

- Developed a high-performance mapping engine in C++ to process OpenStreetMap data and render city maps.
- Designed efficient spatial data structures (quadtrees) for dynamic querying and smooth zoom-based rendering.
- Implemented advanced pathfinding algorithms (Dijkstra, A*) for route planning and delivery optimization.
- Integrated real-time features like day/night mode, weather data, and AI-powered route descriptions.
- Enhanced performance with multithreading (OpenMP) and RESTful API integration (libcurl).

Diary with AI Feedback

Sep 2023 – On Going

- Designed and implemented a journaling program integrated with OpenAI’s GPT API, generating insightful feedback and suggestions for over 570 diary entries.
- Developed a diary sorting algorithm to retrieve contextually similar past entries, enhancing user experience and maintaining API costs below 0.2\$ per call.
- Optimized data-sorting pipelines and API request processes, reducing average diary load time from 10s to 0.5s, enabling seamless daily use.

Verilog Pac-Man Game (University of Toronto)

Nov 2024

- Created a Pac-Man-style FPGA game using Verilog supporting PS/2 keyboard input and VGA output.
- Debugged signal synchronization issues and state-machine logic, boosting overall stability and playability.
- Automated image conversion using Python + OpenCV for seamless integration of game graphics.
- Prototyped the game using Pygame, ensuring accurate emulation of the FPGA version for agile development.

WillPower | Time Management & Monitoring

Jan 2025 - Present

- Built a modular system with Raspberry Pi capturing images and sending them to a Windows host for local storage and analysis.
- Deployed Nginx, FastAPI, and libcurl for data transfer, facilitating real-time user monitoring and minimal downtime.
- Currently exploring Azure Face APIs and transfer learning for user-behavior analysis on a dataset of over 20,000

images.

Self-Clone Chatbot with Diary Database

Oct 2024 - Present

- Built a self-hosted AI-powered chatbot that replicates personal interaction styles, deployed using React.js, FastAPI, and Nginx on a Raspberry Pi.
- Integrated OpenAI API and a NoSQL database for real-time Q&A functionality with personal diary data.
- Ensured secure and seamless remote access by implementing TLS encryption, DDNS, and optimizing for daily traffic from personal networks.

Photogate Speed Measurement System

High School Project

- Designed and built 10 laser-based speed measurement units with nixie tube displays for high school physics education.
- Achieved sub-150us measurement precision using Arduino microcontrollers and custom PCB design.
- Developed custom infrared communication protocol supporting 32-byte data transmission for wireless control.
- Created Python GUI using Tkinter for experiment control, real-time monitoring, and data export capabilities.
- Integrated 3D printed components and aluminum framework for durable classroom-ready construction.

Acorn Course Timetable Monitor Crawler

Personal Project

- Built automated Python web crawler to monitor University of Toronto's Acorn course timetable system for real-time changes.
- Implemented intelligent change detection algorithms with robust error handling and automatic recovery mechanisms.
- Developed notification system for course availability updates, helping students secure spots in full courses.
- Created comprehensive logging system for tracking enrollment patterns and course schedule modifications.

AWARDS & ACCOMPLISHMENTS

University of Toronto Excellence Award (UTEA)

Apr 2025

- Awarded UTEA for top academic performance and research potential.
- Completed a 14-week full-time research project with faculty supervision.
- Received \$7,500 scholarship for research excellence and inclusion.

ECE Awards & Dean's List Scholar (UofT)

Sep 2024

- Recognized for outstanding academic performance (GPA 3.92/4.0).

American Computer Science League (ACSL) - Bronze Prize

Jan 2021

- Placed in top 10% overall, with top-20% scores in the 4th round, after 60 hours of training.