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 (cGPA: 3.87/4.0)
Relevant Courses: Digital Logic Design, Computer Architecture, Real-Time Systems, Signal Processing

TECHNICAL SKILLS

- **Embedded Programming:** C/C++, Assembly (RISC-V, ARM), Python, Real-time Programming
- **Hardware Platforms:** FPGA (Intel DE1-SoC), STM32, Arduino, Raspberry Pi, Nios-V, ARM Cortex
- **Hardware Design:** Verilog, PCB Design, Circuit Analysis, Digital Signal Processing
- **Tools & Protocols:** Quartus, ModelSim, Git, I2C, SPI, UART, CAN, GPIO, PWM, ADC/DAC
- **Robotics & Control:** PID Control, Sensor Integration, Motor Control, Computer Vision

EXPERIENCE

Research Assistant, Wireless Power Transfer Coil Design (University of Toronto) Jul 2025 - Aug 2025
Research Intern, X-Lab, University of Toronto *Toronto, ON*
- Designed 13.56MHz WPT coils for a BCI implant (3mm×8mm RX, ~20mm link).
- Ran HFSS sweeps (turns, trace size, TX diameter) to quantify impacts on coupling (k) and quality factor (Q).
- Produced PCB layouts with tuning plan; distilled design rules and prepared prototypes for validation.
- Implemented embedded control systems for power regulation and wireless communication protocols.

Research Assistant, Ultra-Wideband Receiver Design (University of Toronto) Jun 2025 - Jul 2025
Research Intern, X-Lab, University of Toronto *Toronto, ON*
- Verified hybrid PPM+PSK TX chip pre tape-out; built embedded signal processing systems for 2ns symbol sync.
- Implemented real-time pulse-position detection algorithms on embedded processors with sub-microsecond latency.
- Developed low-level drivers and interrupt handlers for high-speed data acquisition systems.

PROJECTS

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.
- Replaced all floating-point math with **32-bit phase accumulators** and fixed-point kernels for real-time audio processing.
- Designed an **ADSR envelope engine** with hardware-software co-design; integrated slide-switch GPIO and push-button interrupts.
- Integrated PS/2 keyboard interrupts for sub-μs latency note-on/off events with real-time response guarantees.
- Built custom VGA display controller with double-buffered 320×240 output and modular drawing primitives for live waveform visualization.
- Implemented efficient memory management and DMA transfers for seamless audio streaming without buffer underruns.

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.
- Implemented complex finite state machines for game logic, collision detection, and real-time sprite rendering.
- Designed custom memory controllers and video timing generators for stable 60Hz VGA output.
- Debugged signal synchronization issues and clock domain crossing problems for robust embedded system operation.
- Integrated embedded image processing pipeline with Python + OpenCV for graphics conversion and optimization.

Photogate Speed Measurement System High School Project
- Designed and built 10 laser-based speed measurement units with 7-segment displays for high school physics educa-

tion.
- Achieved sub-150us measurement precision using Arduino microcontrollers with interrupt-driven timing algorithms.
- Developed custom infrared communication protocol supporting 32-byte data transmission with error correction.
- Implemented precise timing circuits with crystal oscillators and hardware timer peripherals for accurate measurements.
- Created Python GUI using Tkinter for experiment control, real-time monitoring, and USB serial communication.
- Integrated 3D printed mechanical components with embedded electronics for durable classroom-ready construction.

WillPower | Time Management & Monitoring Jan 2025 - Present
- Built a distributed embedded system with Raspberry Pi capturing images and transmitting to Windows host for analysis.
- Implemented real-time data acquisition with camera interfacing, GPIO control, and network communication protocols.
- Deployed embedded web server using Nginx and FastAPI for RESTful API communication between distributed nodes.
- Developed low-power operation modes and efficient data compression algorithms for continuous monitoring applications.
- Created robust error handling and watchdog systems for autonomous embedded operation with minimal supervision.

Autonomous Robot Navigation System Academic Project
- Developed autonomous navigation system using STM32 microcontroller with sensor fusion algorithms.
- Implemented PID control systems for motor control and path following with real-time feedback control.
- Integrated ultrasonic sensors, IMU, and encoders for obstacle avoidance and localization.
- Built custom PCB with power management, motor drivers, and sensor interface circuits.
- Programmed embedded C firmware with FreeRTOS for real-time task scheduling and interrupt handling.

IoT Environmental Monitoring Station Personal Project
- Designed wireless sensor network using ESP32 microcontrollers for environmental data collection.
- Implemented low-power wireless communication protocols (WiFi, Bluetooth) for remote data transmission.
- Integrated multiple sensors (temperature, humidity, air quality) with calibration and filtering algorithms.
- Developed embedded web interface for real-time monitoring and historical data visualization.
- Created battery management system with solar charging capability for outdoor deployment.

Digital Signal Processing on Embedded Systems Academic Project
- Implemented real-time FIR and IIR filters on ARM Cortex-M processors for audio signal processing.
- Optimized fixed-point arithmetic algorithms for embedded processors without floating-point units.
- Developed efficient circular buffer implementations and DMA-based data transfer for continuous processing.
- Created comprehensive testing framework with signal generators and automated verification systems.

Core AI Developer, Wrong-Tree Unity Game Dec 2024 - Jan 2025
- Designed 9-state finite state machine for intelligent NPC behaviors with real-time decision-making algorithms.
- Implemented efficient proximity detection and dynamic reputation scoring systems optimized for embedded-style constraints.
- Created modular utility systems including random walk algorithms and distance-based targeting for resource-constrained environments.
- Built scalable multi-agent interaction framework supporting simultaneous operations with minimal computational overhead.

City Mapify – Interactive City Mapping Application (University of Toronto) Jan 2025 - Apr 2025
- Developed high-performance mapping engine in C++ optimized for embedded and resource-constrained systems.
- Designed efficient spatial data structures (**quadtrees**) for real-time querying with minimal memory footprint.
- Implemented pathfinding algorithms (**Dijkstra, A***) optimized for embedded processors with limited computational resources.
- Enhanced performance with multithreading techniques suitable for multi-core embedded architectures.

AWARDS & ACCOMPLISHMENTS

University of Toronto Excellence Award (UTEA) Apr 2025
- Awarded UTEA for top academic performance and research potential in embedded systems.
- Completed a 14-week full-time research project focusing on embedded hardware design and implementation.

- Received $7,500 scholarship for research excellence and inclusion.

ECE Awards & Dean's List Scholar (UofT) Sep 2024
- Recognized for outstanding academic performance in embedded systems and computer engineering courses.