Tianchen Song

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EDUCATIONAL BACKGROUND

University of Nottingham, Ningbo, China 09/2018 - 07/2022

BEng in Electrical and Electronic Engineering | Overall GPA: 3.89/4.0 | First Class with Honours | Dean's scholarship (2021.12)

Coursework (Nottingham): Multivariable Calculus | Linear Algebra | Advanced Engineering Mathematics | Robotics, Dynamics and Control | Modeling: Methods and Tools | Information and Systems | Computer Aided Engineering | Electronic Processing and Communication | Analogue Electronics | Computer Vision | Applied Electrical and Electronic Engineering: Construction Project

STANDARDIZED TESTS

GRE General: V: 155 / Q: 168 / AW: 3.5 / Total: 323 | **IELTS:** R: 9.0 / L: 8.0 / W: 6.5 / S: 6.0 / Total: 7.5

SKILLS

Programming Languages: C/C++ | Python | Matlab | Verilog | Swift
Web Development: Html | CSS
Libraries: TensorFlow | PyTorch | OpenCV | NumPy | Matplotlib
Software: ROS | SolidWorks | Arduino | Linux | Keli MDK | STM32CubeMX | PLECS | ADS | LTspice | KiCad

COURSE PROJECTS

Practical Engineering Design Solutions and Project Development **Course Project, University of Nottingham** 10/2020 – 05/2021

- Designed and constructed a Switch Mode Power Supply:
  - Gained familiarity with the working principle of switch mode power supply, control algorithms, and simulation software.
  - Developed a model in MATLAB to simulate the response of the control loop with tuning the values of electronic components.
  - Design the circuit and developed a model in PLECS to simulate the performance of whole switch mode power supply and validate the thermal design.
  - Designed the transformers and inductors quantitively for desired capacity and made them for further use in this project.
  - Designed the PCB of the main board of SMPS in KiCad to integrate an array of electronic components, including a PWM generator, MOSFETs, transformers, MOSFET gate driver circuits, among other peripheral equipment and components, followed by soldering, wire connection, and hardware test.
  - Upgraded the SMPS with integration of ACS712 current sensing chip so as to make over-current protection

Practical Engineering Design Solutions and Project Development **Course Project, University of Nottingham** 10/2020 – 05/2021

- Designed, prototyped, and experimentally characterized a radar speed detector:
  - Designed and implement a 2nd order active Butterworth filter for noise suppression and signal amplification.
  - Performed fast Fourier transform on STM32 for main frequency component extraction of the radar signal.
  - Designed a digital circuit on Xilinx CPLD with Verilog for UART signal decoding and LED display.
  - Experimentally verified the new design's accuracy and reliability compared to the commercially available radar speed meters.

Applied Electrical and Electronic Engineering: Construction Project**, University of Nottingham** 03/2020 – 06/2020

- Designed, implemented, and tested an autonomous line-following robotic vehicle based on Raspberry Pi and OpenCV:
  - Designed the PCB of H-Bridge motor control circuit in KiCad to integrate an array of electronic components, including MOSFET driver, MOSFETs among other peripheral equipment, followed by soldering, wire connection, and hardware test.
  - Enabled recognition of traffic light and road signs based on an array of classical computer vision algorithms implemented in C++ using Raspberry Pi and OpenCV API, with a focus on navigating through a preset route while performing various dynamics maneuvers following model road signs.
  - Enabled remote monitoring and control of the robotic vehicle via an Arduino-based controller using a pair of wireless modules nrf24l04.
  - Built and parametrically optimized a PID controller to improve the line-tracking performance.

Computer Aided Engineering **Course Project, University of Nottingham** 10/2019 – 05/2020

- Designed a self-service restaurant ordering system in C++, featuring with
  - Different dishes available for order in different time slots
  - User-friendly interface and prompt
  - Receipt with ordering information printed when finish ordering and automatic cashing
- Reviewed and implemented an array of classical and newly published computer vision models in python, spanning
  - Face recognition based on histogram of oriented gradients feature descriptor and multiple-scale sliding window method
  - Image-to-image translation with Generative Adversarial Networks
  - Very deep convolutional networks for large-scale image recognition
  - Object detection with YOLO

Information and System **Course Project, University of Nottingham** 09/2019 – 12/2019

- Designed and simulated transistor amplifiers of three types, i.e., common collector, common base and common emitter using Advanced Design System (ADS) software.

- Designed a CMOS-based fully differential op-amp with low voltage, low energy consumption, desired phase margin and large gain bandwidth.
- Modeled the low-voltage single-bit 4th order DSM for encoding analog signals into digital signals as part of analog-to-digital conversion:
  - Performed simulation in MATLAB Simulink and ADS software.
  - Quantitatively studied the impact of integrator's signal amplitude, noise source, op-amp's static/dynamic characteristics and comparator's offset voltage on the signal-to-noise (SNR) of the modulator output signal.

RESEARCH EXPERIENCES

Deep Learning for Medical Image Segmentation

***Research Assistant* | Sir Peter Mansfield Imaging Center, UNNC | Advisor: Dr. Chengbo Wang** 06/2020 – 08/2020

- Built, trained, and validated U-Net convolutional neural networks in TensorFlow for fast biomedical image segmentation: 1) redesigned the network to output desired image size; 2) tested the impact of padding and dropout in convolutional layers on prediction accuracy; 3) experimented with the elastic deformation method for data augmentation, the overlap-tile strategy for seamless segmentation, and the Adam optimizer for improved convergence rate.

Development of an On-campus Autonomous Delivery Vehicle

***Team Leader* | Innovation Lab, UNNC | Advisor: Dr. Adam Rushworth** 12/2020 – 09/2021

- Implement a RTK-GPS-guided autonomous vehicle with mechanical modification to the chassis for on-campus package delivery:
  - Designed the mechanical structures for package storage and sensors integration.
  - Implemented a deep learning model in PyTorch to drive real-time RGB-D camera frame segmentation to detect the collision-free space for obstacle avoidance purpose on NVIDIA Jetson; further enhance system robustness by integrating radar and ultrasonic sensor data.
  - Developed a signal conditioning system on ROS to extract, process, and fuse raw data from an array of sensors, including GPS module, radars, IMU, wheel encoders, RGB-D cameras, and ultrasonic sensors.
  - Fused the GPS and IMU data using Kalman filter to obtain a continuous position estimation.
  - Developed a local path planning algorithm for obstacle avoidance, with a focus on multi-sensor data fusion and utilize A* algorithm for global path finding.
  - Developing the delivery service functionality and human-robot interaction for delivery service using.

Development of an Indoor Autonomous Cruise Robotic Vehicle

Senior Year Project | Advisor: Dr. Liang Huang 10/2021 – 05/2022

- Design, prototype and test an autonomous vehicle capable of performing indoor navigation based on UWB technology:
  - Utilized DWM1000 UWB compliant wireless transceiver module to enable indoor localization and utilize A* algorithm for global path planning.
  - Converted the PyTorch model for collision-free space segmentation to TensorRT inference engine to get about 3 times faster real-time performance on Jetson board.
  - Developed a suite of control algorithms in Python to enable real-time steering, speed control and path-finding based on sensor data; perform microcontroller unit programming in C; develop the system based on ROS mainly in Python.
  - Build a GUI in Swift general-purpose programming language for monitoring and controlling the robot through Bluetooth on an iOS device

EXTRACURRICULAR EXPERIENCES

Minister of Public Relation | University of Nottingham Students' Union 09/2018 – 09/2020

- Planned, promoted and coordinated multiple on-campus events, e.g., singing contests, debating competitions, Christmas carnivals, new year's concerts and galas; secured financial supports from an array of external enterprises and organizations.

Member | Science and Engineering Students Association, University of Nottingham 09/2018 – 06/2019

- Coordinated a series of activities to encourage and support study of STEM subjects within Nottingham student community, e.g., math competitions, bi-weekly seminars, technical presentations, sharing of research findings, public services to local elementary and high schools, and various fun activities.
- Invited professors to give informal seminars on their research and career experiences; collected reading materials and organize study sessions to assist in the academic pursuit of students.