Dr. Salman Hafeez

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Education

Ph.D. Electrical Engineering

University* of Newcastle, NSW, *Australia

2014- 2018

Thesis: *A Control-Theoretic Approach to Incorporate Uncertainty into the Dynamic Integrated Climate-Economy (DICE) Model*

Master's in Business Administration (MBA Executive with Distinction)

University of Essex, Colchester, United Kingdom 2018-2020

BSc. Electrical Engineering (CGPA: 3.731/4.0)

University of Engineering and Technology, Lahore*, *Pakistan 2008-2012

Relevant Professional Experience

Embedded Software Engineer (Robotics and Controls)

Ocado Technology, Welwyn Garden City, United Kingdom 2020-Current

Swiftfields, AL7 1LY United Kingdom

Responsible for designing, developing, and maintaining the bare-metal software that powers Ocado Grocery Picking Robots, focusing on *PID* control algorithms, *odometers* integration, and *CanOpen* communications protocols within embedded hardware. Exercising deep expertise in *Embedded C* programming, *STM32* micrcontrollers platform, and QPC real-time operating systems *(RTOS)* while collaborating closely with hardware engineers and other software teams to bring robotic functionalities to life.

Key Achievements:

- Contributed to the odometer replacement project for bots with an algorithmic solution, resulting in $5M Capex cost savings.
- Delivered a *Python/SQL* based insights dashboard from concept to completion, processing 4TB data per day.
- Created a RAG AI chatbot MVP based on Lang chain and OpenAI APIs for boosting productivity.

Key Skills:

- Embedded C, STM32, RTOS
- Python, SQL, Big query, Data Analysis
- CanOpen communication
- Agile/Kanban

Robotics Research Associate (R&D Engineer)

University of Essex, United Kingdom 2017-2020

(Project funded by the UK government)

Wivenhoe Park, Colchester CO4 3SQ, Essex, United Kingdom

Responsible for design and development of industrial automation solutions for polymer testing lab. Designing robotics XYZ pick and place system, implementing *PID* control algorithms in *Embedded C* for stepper motor control on ARM M4 microcontroller, and writing libraries for customized *RS232/RS485* communication protocols. Integrating temperature sensors, and creating a *C#/WPF* based UI for the control the equipment

Key Achievements:

- Delivered a robotic polymer handling system that increased user safety
- Delivered a production ready UI supervisory control app for the polymer measurement system that boosted revenue by 50%.

Key Skills:

- Robotics systems development using linear and rotary electric actuators.
- C#/WPF programming in Visual Studio for HMI development
- Industrial communication: RS485, RS232, SPI, I2C
- Embedded firmware development in C and ARM Cortex M4 microcontrollers

Industrial Project Experiences

RAG AI Chatbot

- A web-based AI chatbot with RAG capability for answering questions abouts proprietary documents using retrievers and similarity searches
- The project deployed a Python based Flask server and used Lang Chain and OpenAI LLMs.

Virtual Odometer

- An Embedded C software solution for performing odometry based on motor feedback data.
- This project was implemented on STM32 and used the exponential moving average smoothing for processing signals.

3D – Robotic pick and place system

- A closed-loop feedback control system is being designed to implement a xyz linear robotic pick and place system using stepper motors, optical encoders, linear guide rails, and force/pressure sensors
- This project was integrated into the ARM SAM4S microcontroller, programmed in C language using Atmel Software Framework

Wi-Fi enabled handheld controlling device

- Developed the complete system to enable the control of appliances with portable devices such as smart phones.
- This project integrated PIC18F4620 micro-controller, ENC28j60 Ethernet module and C language. The complete TCP/IP stack was implemented within the limited memory of micro-controller with build-in support for DHCP.

Ethernet packet capturing and decoding

- Developed a C language-based application to capture and decode the real time Ethernet packets. This project utilized the" Winpcap" API and visual studio development tools.

Light following robot

- Designed a robot which could sense light and move towards the brighter light source.
- The project was implemented by using Operation Amplifiers, 8051 micro-controller, assembly language and DC geared motors.

Home automation: Infrared

- Developed the complete system for controlling the home appliances with a Philips TV remote control
- The RC5 protocol decoder was implemented with 8051 micro-controller and assembly language along with the IR sensors.

Other projects can be viewed at: goo.gl/6e9xc0

Google scholar profile available at: https://scholar.google.com.au/citations?user=0fFANfEAAAAJ&hl=en

1. **Hafeez S.,** Weller S. R., Kellett C. M. Impact of climate model parametric uncertainty in an MPC implementation of the DICE integrated assessment model. IFAC-PapersOnLine. 2017 Jul 1;50(1):959-65. ***Received the IFAC inaugural award for this paper***
2. **Hafeez, S**., Weller, S. R., and Kellett, C. M. (2015). Steady-state and transient dynamic behavior of simple climate models for application in integrated assessment models. In *5th Australian Control Conference (AUCC)* (pp. 269-273). Gold Coast, Australia: Engineers Australia.
3. **Hafeez, S.,** Weller, S.R., and Kellett, C.M. (2016). Transient climate response in the DICE integrated assessment model of climate economy. Accepted for *Australian Control Conference (AUCC 2016).*
4. Weller, S. R., **Hafeez, S**., and Kellett, C. M. (2015). A receding horizon control approach to estimating the social cost of carbon in the presence of emissions and temperature uncertainty. In *54th IEEE Conference on Decision and Control (CDC 2015)* (pp. 5384-5390). Osaka, Japan: IEEE.
5. Weller, S. R., **Hafeez, S.,** and Kellett, C. M. (2015). Feasibility of 2 °C as a post-2020 warming threshold via input-constrained optimal control. In I. Petersen, & S. Moheimani (Eds.), *2015 IEEE Multi-Conference on Systems and Control* (pp. 1117-1123). Sydney, Australia: IEEE.
6. Weller, S. R., **Hafeez, S.,** and Kellett, C. M. (2015). Estimates of the social cost of carbon using climate models derived from the CMIP3 ensemble. In P. Jeyapal (Ed.), *Proc. 3rd ASEAN Australian Engineering Congress (AAEC 2015)* (pp. 84-89). Barton, ACT: Engineers Australia.