

James Devine

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Education

Ph.D. Computer Science

LANCASTER UNIVERSITY

Lancaster, England

Jan. 2016 - May. 2020

Undertook research on lowering the barrier to entry for innovation with microcontroller-based devices. Collaborated with a number of companies, including Microsoft, ARM, Farnell, and Samsung to produce the device runtime for the BBC micro:bit. Generalised this runtime to support a range of other products, enabling Microsoft MakeCode to reach millions of users. Applied this research in a number application contexts including Energy in Schools, where I implemented a wireless IoT infrastructure for educators and students to reduce energy consumption, and Project Brookdale, where I designed systems and hardware for designers to use in a tech-enhanced fashion show.

B.Sc. Computer Science, First Class (Hons)

LANCASTER UNIVERSITY

Lancaster, England

Oct. 2012 - June 2015

In my 3 year undergraduate program, I started my own 3D printing design company, lead a prizewinning group project, and spent two years developing the university's flagship smart phone application whilst achieving a grade within the 95th percentile of my cohort. For my dissertation project I created a per-appliance current sensing device, accompanying IoT infrastructure, and a cross-platform smart phone application for visualising data.

Experience

Long-tail Hardware

RESEARCHER, MICROSOFT RESEARCH

Cambridge, UK

June. 2020 - Present

Continuing my work on physical computing under the umbrella of long tail hardware. Generally, I will be building tools, systems, and experiences that make it easier to produce hardware at scale. Fundamental to this work are CODAL and JACDAC, technologies contributed in my thesis.

- Implemented JACDAC on a 2.5 cent microcontroller.
- Designed and developed the micro:bit MakeCode Arcade shield.

Project Brookdale

INTERN, MICROSOFT RESEARCH

Redmond, USA

Feb. 2019 - May 2019

Collaborated with Microsoft Research and the University of Calgary to develop intuitive wearable fashion technology, subsequently deployed and evaluated at a high profile fashion show in Brooklyn, New York. Fashion designers were able to realise their design vision for fashion-tech garments, by embedding microcontrollers and sensors and dynamically integrating them via the JACDAC protocol. [This was documented in a Microsoft Research blog post.](#)

- Worked with fashion designers and models to build and debug garments at a Brooklyn Fashion Show.
- Created a custom PCB for prototyping JACDAC devices.
- Developed a JACDAC typescript stack to enable the Web browser to act as a JACDAC debugger and device over WebUSB.
- Presented JACDAC and Project Brookdale at Microsoft Research TechFest 2019.

JACDAC

INTERN, MICROSOFT RESEARCH

Redmond, USA

Jun. 2018 - Sep. 2018

Created a wired networking protocol for dynamically integrating embedded devices and peripherals. To make connecting devices more accessible, JACDAC uses a 3.5mm audio jack connector. JACDAC is used as the interconnectivity solution for [MakeCode Arcade](#) devices.

- Defined and developed the JACDAC protocol stack from the physical layer, to the control layer, to the software driver models used by developers.
- Implemented the protocol on three different processor classes to prove viability.
- Presented the protocol to colleagues within Microsoft Research and the MakeCode team for input and feedback.

Energy in Schools

RESEARCH ASSOCIATE, LANCASTER UNIVERSITY

Lancaster, England

Jun. 2018 - Sep. 2018

Collaborated with Samsung Research and the Centre for Sustainable Energy to create an Internet of Things (IoT) platform for use in schools. Using the platform, students and teachers could access the real time energy consumption of their school, interact with IoT sensors and actuators, and obtain data from the Internet.

- Worked with educators to implement a platform that was valuable and reliable in the classroom
- Developed a low-infrastructure wireless mesh protocol based on constructive interference using the BBC micro:bit.
- Created a no-installation secure gateway device to join micro:bit mesh networks to IP networks.

Embedded Learning Library (ELL)

Redmond, USA

INTERN, MICROSOFT RESEARCH

Jun. 2017 - Sep. 2017

Undertook an internship with the [ELL](#) team in Microsoft Research Redmond to create a wake-word recognition solution (like “Hey Cortana!”) for resource-constrained microcontrollers.

- Investigated the theory of recurrent neural networks and their role in machine learning
- Developed an efficient C implementation of mel-frequency cepstrum cepstral coefficient calculations
- Created implementations of various neural networks in LLVM and C++: LSTM, GRU, RNN

The BBC micro:bit, MakeCode, and CODAL

Lancaster, England

RESEARCH ASSOCIATE, LANCASTER UNIVERSITY

Jun. 2015 - Present

I co-wrote the micro:bit runtime, a memory efficient lightweight operating system designed to support higher level languages like JavaScript. I later generalised the micro:bit runtime into CODAL, which now supports upwards of 50 devices in the MakeCode programming editor. [The BBC micro:bit](#) is a small embedded physical computing device that was given to 750,000 11–12 year old students in the UK in 2015. Designed to provide an engaging way of learning computer science concepts with a low barrier to entry for educators and students, the micro:bit has grown from strength to strength—over 2 million micro:bits are in use worldwide.

- Helped design and develop the micro:bit runtime, a lightweight operating system that runs in less than 2 kB of RAM.
- Worked as part of a large project team that involved a number of partners, including ARM, Farnell, Samsung, the BBC, and Microsoft.
- I continue to be involved in design discussions and future directions for the [micro:bit foundation](#), and Microsoft MakeCode. I also add new devices to the MakeCode ecosystem using CODAL

Publications

The BBC micro: bit—from the UK to the World

Jonny Austin, Howard Baker, Thomas Ball, James Devine, Joe Finney, Peli Halleux, Steve Hodges, Michał Moskal, Gareth Stockdale
Communications of the ACM (2020). ACM, 2020

Enabling intuitive and efficient physical computing

James Devine

Thesis (2020). Lancaster University, 2020

MakeCode and CODAL: intuitive and efficient embedded systems programming for education

James Devine, Joe Finney, Peli Halleux, Michał Moskal, Thomas Ball, Steve Hodges

Journal of Systems Architecture (2019). Elsevier, 2019

IoT4Kids: Strategies for Mitigating Against Risks of IoT for Children

Bran Knowles Knowles, Sophie Beck, Georgia Newmarch, Joe Finney, James Devine

In proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (2019). ACM, 2019

A Scenario-Based Methodology for Exploring Risks: Children and Programmable IoT

Bran Knowles, Sophie Beck, Joe Finney, James Devine, Joseph Lindley

Proceedings of the 2019 on Designing Interactive Systems Conference, 2019

Energy in Schools: Promoting Global Change through Social Technical Deployments

Kathy New, James Devine, Taylor Woodcock, Sophie Beck, Joe Finney, Mike Hazas, Nick Banks, Karen Smith, Tim Bailey

In Living in the Internet of Things: Harnessing Economic Value (2019). IET, 2019

MakerArcade: Using Gaming and Physical Computing for Playful Making, Learning, and Creativity

Teddy Seyed, Peli Halleux, Michał Moskal, James Devine, Joe Finney, Steve Hodges, Thomas Ball

Extended Abstracts of the 2019 CHI Conference on Human Factors in Computing Systems, 2019

MakeCode and CODAL: Intuitive and Efficient Embedded Systems Programming for Education

James Devine, Joe Finney, Peli Halleux, Michał Moskal, Thomas Ball, Steve Hodges

Proceedings of the 19th ACM SIGPLAN/SIGBED International Conference on Languages, Compilers, and Tools for Embedded Systems, 2018

What children’s imagined uses of the BBC micro: bit tells us about designing for their IoT privacy, security and safety

Bran Knowles, Joe Finney, Sophie Beck, James Devine

In Living in the Internet of Things: Cybersecurity of the IoT (2018). IET, 2018

WORKS IN PROGRESS

JACDAC: A protocol for the dynamic integration of embedded devices and peripherals

James Devine, Peli Halleux, Michał Moskal, Joe Finney, Steve Hodges, Thomas Ball, Teddy Seyed

Under revision (UbiComp), 2020

Rethinking the Runway: Designing a Modular, Plug and Play System for Wearables using Avant-Garde Fashion

Teddy Seyed, James Devine, Peli Halleux, Michał Moskal, Joe Finney, Steve Hodges, Thomas Ball

Under submission (CHI 2020). 2020

Awards

- 2018 **Associate Fellow of the Higher Education Academy**, Higher Education Academy *Lancaster, England*
- 2017 **Staff impact award**, Lancaster University *Lancaster, England*
- 2016 **PhD scholarship**, Microsoft Research *Cambridge, England*

Talks & Presentations

Citizen engineering: enabling community innovation

LANCASTER UNIVERSITY FACULTY CONFERENCE

- Invited talk at Lancaster University's Faculty of Science and Technology conference.

Lancaster, England

Dec. 2019

Turning Blocks into Code with MakeCode and CODAL

MICRO:BIT LIVE

- Delivered an introductory deep-dive on programming the BBC micro:bit in C/C++.

Manchester, England

Oct. 2019

Presenting Project Alava

MICROSOFT RESEARCH FACULTY SUMMIT

- Co-presented Project Alava, a project that enables novices to more easily connect, compose, and program microcontrollers.

Redmond, USA

Jul. 2019

Presenting Project Brookdale

MICROSOFT RESEARCH TECHFEST

- Co-presented Project Brookdale, a toolkit that allows fashion designers to more easily embed microcontrollers and sensors into garments.

Redmond, USA

Feb. 2019

Careers Day

OWLSMOOR PRIMARY SCHOOL

- Inspired primary school students to get involved in computer science by talking about my experiences.

Sandhurst, UK

Nov. 2018

MakeCode and CODAL: Intuitive and Efficient Embedded Systems Programming

CONFERENCE ON LANGUAGES, COMPILERS, AND TOOLS FOR EMBEDDED SYSTEMS

- Presented MakeCode and CODAL to the research community at LCTES 2018.

Philadelphia, PA

Jun. 2018

The micro:bit runtime inside and out

MICROSOFT RESEARCH

- Invited talk on the design goals and implementation of the micro:bit runtime.

Redmond, USA

Sep. 2016

Teaching & Mentoring

Module Technical Lead

LANCASTER UNIVERSITY

- Designed teaching materials for the undergraduate embedded systems module SCC369.

Lancaster, England

Oct. 2019

Dissertation Project Advisor

LANCASTER UNIVERSITY

- Advised and assisted students undertaking their final year dissertation projects at Bachelors and Masters level.

Lancaster, England

Jan. 2016 - Sep. 2019

Teaching Associate

LANCASTER UNIVERSITY

- Taught on a range of modules, including: Advanced Programming, Embedded Systems, Operating Systems, and Networking.

Lancaster, England

Jan. 2016 - Jan. 2018

Hobbies & Interests

Maker · Tinkerer · Hacker · Musician · Motorcyclist