As featured in the UNIVERSITY OF WATERLOO MAGAZINE | SPRING 2014

hardware revolution

Manufacturing the future, from wearable technology to high-tech tools
HARDWARE

Manufacturing the future, from wearable technology to high-tech tools

TEXT BETH GALLAGHER
More than just apps, companies such as Palette are building high-tech gear to meet growing consumer needs.

Long before Clearpath Robotics was a multi-million dollar operation with a global reputation it was a humble Waterloo startup with a space issue. Matt Rendall had a dream of building robots. But almost five years ago — ancient history in the life of a startup — there came a point when his robots would no longer fit under his desk.

For a while, he stored them on top of his desk. When the boxes started spilling into the hallways of the Accelerator Centre, he knew it was time for Clearpath Robotics to move.

“It was starting to become clear that traditional office space didn’t mesh with the needs of a hardware startup,” says Rendall, CEO of Clearpath Robotics who founded the company with fellow University of Waterloo mechatronics engineering program graduates Bryan Webb, Ryan Gariepy and Pat Martinson.

“We were doing our engineering design, sales and marketing in the office during the day,” he says. “But at night, after everyone went home, we’d set up in an empty boardroom in the Accelerator Centre. We’d lay newspaper down on the board table and build our robots. We’d set up production lines. We had nine guys crammed into a boardroom that was no more than 200-square-feet.

“We’d work until midnight. Then we’d take a break and play video games. After that, we’d pack everything up and stick it back under our desks.”

The Accelerator Centre on the north campus of the University of Waterloo was established to give early-stage companies everything from office space to connections and capital.

It wasn’t, however, designed for building robots.
This year, Clearpath Robotics is moving into a 12,000-square-foot building in Kitchener and doubling its staff while celebrating the sale of its 1,000th robot. At the same time, the University of Waterloo's startup incubator, Velocity, is opening the Foundry, a new workspace that will support entrepreneurs with a passion for hardware.

“Software and hardware startups experience fundamentally different challenges, says Rendall, also a grad of Waterloo’s Master of Business, Entrepreneurship and Technology program. “The Foundry is going to provide hardware entrepreneurs with a community of people who share similar challenges. It would have been great to have had that in Clearpath’s early days. We could have had a better understanding of the hardware business model and the global manufacturing landscape.”

The Foundry will forge a new hardware community

The new 11,000-square-foot Velocity Foundry will open this summer. The Garage program gives Waterloo students and alumni access to funding, free workspace and mentors. While Velocity programs have already supported successful hardware startups, the new Foundry will offer hardware entrepreneurs more space, tools, light-manufacturing machinery and the freedom to make noise.

“At the Foundry, hardware entrepreneurs will be working on physical products so there will be noise,” says Mike Kirkup, director of Velocity. “Whether it’s the sander or the drill press or an electric motor, these things make noise.

“The only noise software companies make, other than talking, is fingers on keys. It’s a very different environment.”

The Foundry is the next step for the University of Waterloo in what has already been an impressive list of hardware startups. While the tech media buzzes about a hardware revolution, consumers are flocking to cool new products, such as Thalmic Labs’ Myo armband.

Like Clearpath Robotics, all three of Thalmic Labs’ co-founders graduated from Waterloo’s mechatronics engineering program. As one of the first hardware companies to graduate from the Velocity Garage, Thalmic Labs hit the ground running with its Myo armband, a device that lets you use the electrical activity in your muscles to wirelessly control your computer and phone.
Thalmic, which announced a $14.5-million round of funding last year, plans to start shipping Myo Developer kits in the first half of the year, with final units to follow.

Thalmic co-founder Stephen Lake says the early days of building a hardware startup were challenging. There wasn’t room to build in the Garage at the time, so Mike Kirkup and Communitech CEO Iain Klugman found space in The Tannery building. Lake and his young team set up in an empty room with a couple of lights and a few plugs in the wall.

“We bought some old workbenches and tools off Craigslist, cheap, and we had a 3D printer up there and some electronics assembly and test equipment,” recalls Lake.

“We were one of the early hardware companies that was part of Velocity, but everyone always found ways to help us get what we needed.”

With their shared interests and challenges, hardware entrepreneurs from Waterloo support one another even after they’ve moved on from the early stages of their companies. Just this year, Clearpath Robotics and Thalmic Labs released a video showing how the Myo armband was used to start, stop and drive Clearpath’s Husky Unmanned Ground Vehicle.

Every Waterloo grad with an interest in hardware has a unique path.
Mike McCauley co-founded BufferBox with two other Waterloo mechatronics engineering grads, and grew the business in the Velocity incubator. BufferBox, which was purchased by Google in 2012, built kiosks that allowed consumers to pick up online purchases 24/7. More recently, Google announced the division would be merged with other operations in Silicon Valley.

Other alumni established their hardware startups in Silicon Valley. Eric Migicovsky, a graduate of Waterloo Engineering’s system design program, founded Pebble in 2008 and began developing a smart watch that raised $10 million on a Kickstarter campaign. Earlier this year, Pebble announced it sold 400,000 watches in 2013 and expects to double revenue this year.

Another early hardware startup was Aeryon Labs, now a global leader in aerial robotics, or drones, that was founded in 2007 by Waterloo Engineering grads and is based in Waterloo.

The next wave of University of Waterloo hardware startups

Out of the new crop of hardware startups at the Velocity Foundry will be Palette, a company started by two recent mechatronics engineering grads who raised more than $150,000 this year on Kickstarter. Palette sells a hardware interface — a series of knobs, sliders, dials and buttons that snap together like Lego — to work with creative software.

The Palette interface can be customized by users who are tired of awkward mouse-dragging and keyboard shortcuts for editing photos, making movies or creating music. Since graduating last spring, Palette co-founder Calvin Chu has been to San Francisco, Shenzhen, China, and back to San Francisco before returning to Kitchener-Waterloo.

In Shenzhen, Chu and co-founder Ashish Bidadi, were part of HAXLR8R, an incubator devoted to hardware startups. They learned about manufacturing, prototyping and electronics, and roamed electronics markets for the best hardware they could find to build their interface.

“If you can imagine city blocks with huge buildings and each floor has booths with vendors of buttons, knobs, LEDs and sliders,” says Chu. “It was like being in the best candy store of cool stuff in the world.”

But like the founders of Thalmic Labs and BufferBox who went to Silicon Valley to be part of the Y Combinator accelerator, Chu and Bidadi decided to return to Kitchener-Waterloo to build their business.

“Obviously, we want to be close to the talent coming out of the University of Waterloo,” says Chu. “We went through Waterloo ourselves, so we know where they’re coming from.”

Chu says being at Velocity has given the Palette team access to successful startups such as Thalmic Labs, which has an office and production facility in an old factory in downtown Kitchener, not far from Velocity Garage.

Hardware networks are important because entrepreneurs who make a physical product share unique challenges that software startups avoid — from the physical mass of their product to shipping in a global marketplace.

The good news, says Kirkup, is that crowdfunding platforms like Kickstarter are making it easier for hardware entrepreneurs to get funding.
These new platforms are rejuvenating the hardware industry," says Kirkup. "They are enabling startups to determine whether their ideas actually solve a problem before they spend significant capital and resources to bring it to market."

Wayne Chang, a Waterloo alumnus who is a lecturer and Enterprise Co-op Coordinator at the University of Waterloo's Conrad Business, Entrepreneurship and Technology Centre, points out the hardware revolution has also been fuelled by drastically falling prices for electronic parts and components.

An entrepreneur and high-tech engineer for 15 years, seven of which were spent working in Silicon Valley, Chang says these positive changes don't diminish the reality of the long road ahead for any young hardware entrepreneur. Chang brought in Pebble founder Migicovsky to share his startup journey with students at Conrad.

They were shocked to hear that Migicovsky's idea was repeatedly rejected by venture capitalists and investors before his persistence paid off.

Long hours and sacrifice are some of the reasons so many young entrepreneurs build their businesses close to the University of Waterloo, with the support of such programs as Engineering Capstone projects, the Velocity Garage and Velocity Foundry.

Chang says it's notable that so many founders are classmates from the Faculty of Engineering. The startup life is an intense one, says Chang.

"You have to really trust everyone on your team," he says. "They all go through the trenches together at Waterloo. They spend their formative years at the University and find their co-founders here."

"They arrive on campus with that deer-in-the-headlights look. But when they graduate, they know who they can trust as they aspire to create new things. They're kindred spirits, and that's why they build companies together." 

WEB see Hardware Revolution at uwaterloo.ca/alumni/links

### Hands-on hardware expertise sets alumni apart

Google[x] is known as a secretive division of the tech giant that develops everything from robots to self-driving cars. It's staffed by some of the world's top innovators — "Peter Pans with PhDs" — who push hardware technology to the bounds of science fiction.

But for University of Waterloo alumnus Rahim Pradhan, the road to Google[x] was more hard work than magic. A graduate of Waterloo's mechatronics engineering program, Pradhan got started in hardware in the University's machine shop during his first co-op job.

The machine shop supervisor was so impressed with Pradhan's work, he wrote him a reference letter.

"At the time, I didn't think much of it," says Pradhan. "But, believe it or not, I actually gave that reference letter to Google when I was interviewing with them."

"I learned how to use everything from milling machines to lathes in the shop. I basically learned how things are made. You can have all these great ideas, but you need to be able to build them. That's why that first co-op job was so great."

Pradhan works in Silicon Valley within the Google[x] group developing the driverless car. He works alongside other engineers dedicated to Google Glass, the augmented-reality glasses. Google[x] also has teams researching how balloons in space could be used to give developing nations internet access, smart contact lenses and new approaches to wind power.

"We want people who can translate ideas into actual products — people who want to launch fast and are not afraid to fail," says Alice Cheung, a Google[x] recruiter. "We want people who have done startups and who have been playing with things for a really long time."

As innovation moves into the hardware space, Google[x] recruiters are looking north for students, like Pradhan, who have hands-on experience.

"Anything physical at this point is really interesting to us," says Cheung. "People have the idea that Google[x] is a secret research lab, but it's actually a really rapid-prototyping hardware lab."

"The fantastic thing about the University of Waterloo is the calibre of candidates. They have so much hands-on work experience. The co-op program is a brilliant idea. I wish more universities did something like that."

Meggie Smith, a Google[x] recruiter who works with Waterloo students and alumni, says she's competing with other companies to get the top talent coming out of Waterloo to help drive the hardware revolution.

Google has a reputation for perks such as free food, yoga classes and rock-climbing walls. But it's working on cool, high-impact technology that should spark the interest of potential recruits.

For Pradhan, a committed hardware engineer, Google[x] has given him the opportunity to follow his passion and work with "really smart people."

"We've seen what software can do," he says. "The software is there. Now we're asking, 'How do we move the hardware forward?' Hardware is the next step forward and Google[x] is all about projects that make contact with the physical world."
MATT RENDALL, CEO of Clearpath Robotics and AARON GRANT, co-founder of Thalmic Labs