

The MagPi

The official Raspberry Pi magazine

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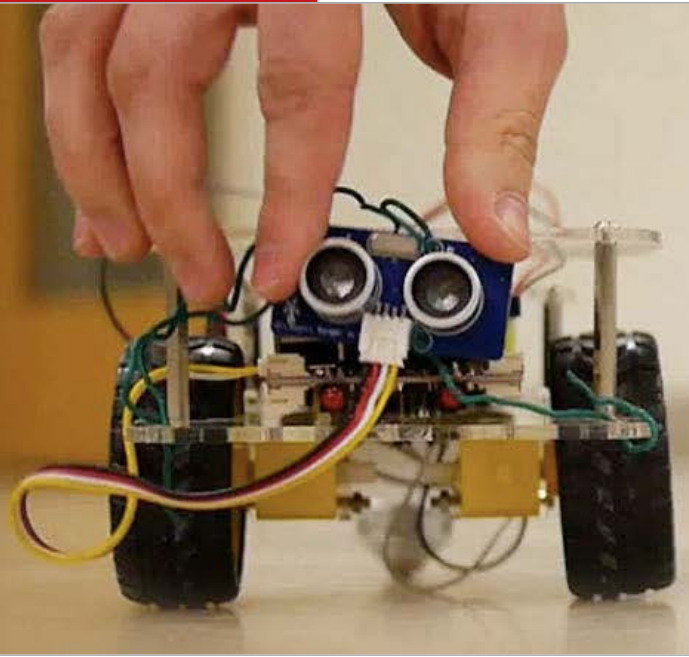
Also inside:

- > HACK A CLOCK WITH YOUR RASPBERRY PI
- > GET CREATIVE WITH CONDUCTIVE PAINT
- > MORE AMAZING PROJECTS REVEALED
- > 4TRONIX AGOBO ROBOT REVIEWED

SCROLL TEXT OVER THE UNICORN HAT

Put your text up in lights with our expert step-by-step guide

Plus HOW TO CONNECT A PRINTER TO YOUR RASPBERRY PI



ROBOTS INVADE OUR COLLEGE CLASSROOMS

MEET YOUR MAKER



The Hood College robotics students were delighted by a surprise visit from GoPiGo creator John Cole, of Dexter Industries, back in March. "Having John in class was a wonderful opportunity for the students to ask questions, work out any kinks, and better understand the rationale behind certain design aspects and features of the platform," enthuses associate professor George Dimitoglou.

John tells us, "It was a great experience to see what the students were doing with the robot, and how they were learning real-life engineering with the GoPiGo and the Raspberry Pi." He was impressed by what the students were doing with the robot: "They were really inventive and had some great feedback for the design. They had designed different ways to mount sensors [and] add traction for wheels on slippery surfaces, and suggestions about where we needed to make our assembly instructions better.

"Where they were most innovative was in the software... I was really impressed by the level at which they were working with Python. What was even better was that since our software is all open source, we could take their suggestions and improve [it] immediately."

Video highlights of the visit can be found at: youtu.be/i1PIORq0ILs.

How a Raspberry Pi robot is helping to teach computer science at Hood College in the USA...

A swarm of mini robots whizz around the classroom floor as the teacher steps through the door. Far from being irate, however, he's delighted that his students have done their homework. For this is the Robotics & Intelligent Systems class at Hood College, Maryland, an upper-level elective for students majoring in Computer Science. Associate professor George Dimitoglou tells us it's a popular course: "I get the students who can't wait to work on robots; I don't have to convince anyone it is interesting or cool..."

Having taught robotics for a number of years, George was looking for a platform to support the use of a modern programming environment, such as Python, that the students already knew or could quickly learn, so they could focus on learning how to develop autonomous, intelligent robotic behaviours.

Dexter Industries' Pi-powered GoPiGo robot fitted the bill, meeting a number of key criteria. "First, it allowed us to use a modern programming environment, which meant we could start doing robotics immediately after kit assembly," explains George. "Second, it gave us the ability to have the full package of everything we need to

exercise autonomous behaviours (microcontroller, servos, sensors). Third, it is an expandable platform; we can add many more sensors and modules to increase its capabilities."

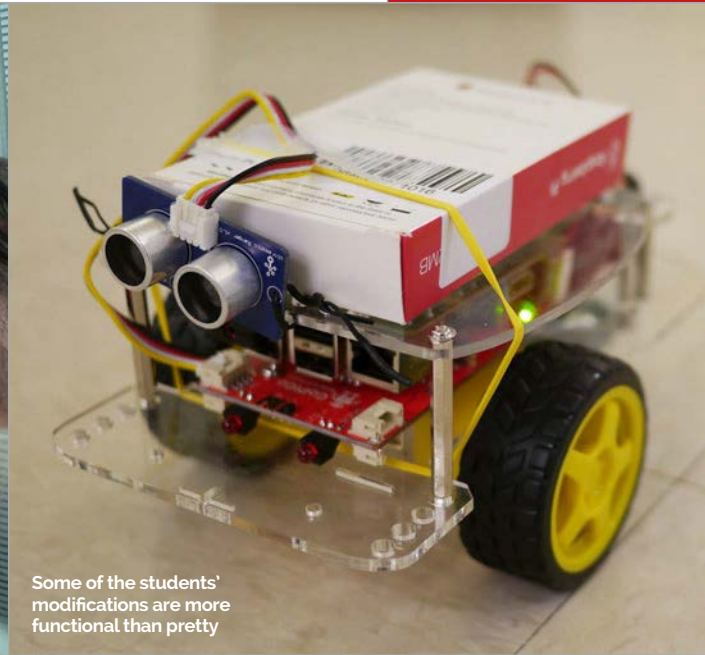
Another advantage is the affordable price: "Having their own robots, rather than depending on a lab-based shared pool of hardware, meant that students can work on their homework and projects anywhere, at home, the library, or at the cafeteria, without worrying about lab hours of operation and access privileges. Plus, they also liked the idea of getting to keep the robot after the course is over."

Parallel parking

It's not just goofing around with tech toys, however. Far from it. Students are expected to implement algorithms for mobile and intelligent behaviours. "We start with basic motion and sensor exercises and quickly program the robots to do obstacle avoidance and different manoeuvres such as a figure-eight around two obstacles, and parallel parking," reveals George. "We then move to more intelligent activities such as incorporating a camera for mapping, browser streaming, and smart navigation to do 'surveillance'."



A selfie of George (second from left) and students, taken from a GoPiGo



Some of the students' modifications are more functional than pretty

So far, the focus is on trying to see what they can do with the unmodified GoPiGo platform. However, one of the students outfitted his robot with a portable USB rechargeable battery, while another created a rotating ultrasonic sensor base using a bottle cap and a screw. "They are not pretty, but I like seeing students being innovative and I encourage it." George and his students have also started looking into integrating more sensors into the GoPiGo: "We are currently experimenting with a low-cost LIDAR to perform distance calculations for mapping using a near-infrared laser beam."

Crash course

George says there are both technical and non-technical educational benefits to the course. As well as being programmable using Python, the GoPiGo has separate hardware components and "[students] learn about the physical 'anatomy' of a robot and what each part does."

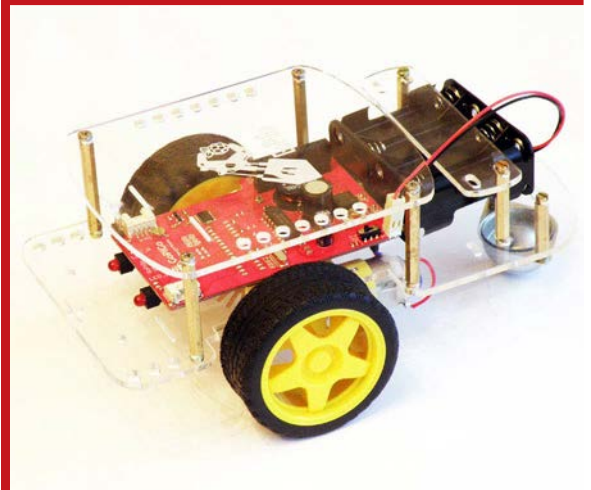
As for the non-technical benefits, George believes that robotics in general is an eye-opener for computer science students. "Robotics is the physical manifestation of computation and for many students – not just my own – it is the first time while programming they get a real emotional connection

“When a robot fails, it runs off the table, crashes on a wall, hits an obstacle...”

Eventually, George would also like to do some distributed coordination activity with multiple robots working together on completing a task, using the WiFi dongle and the GoPiGo's ad hoc networking capabilities. "This type of exercise is what got me into robotics," divulges George. "I got into it while looking for an environment to exercise my theoretical distributed coordination algorithms and I got... sucked in."

with their work product. When software fails, it gives a bunch of warnings and errors on the screen. When a robot fails, it runs off the table, crashes on a wall, hits an obstacle, or completely misses a door. The failure of the computation is suddenly physical, unquestionable, and obvious. Suddenly they realise their code has ramifications and they pay more attention; they even test their programs more."

GOPIGO



Launched via a successful Kickstarter crowdfunding campaign last year, the GoPiGo turns your Raspberry Pi into a fully functional two-wheeled robot. The \$90 Base Kit includes everything you need – the GoPiGo board, chassis, wheels, motors, encoders, and power battery pack – and is easy to assemble.

According to its creator John Cole, of Dexter Industries, the GoPiGo was originally designed to make robotics accessible to everyone, especially in education. "We've got software for it in a lot of languages at this point, including Scratch and Python. Our hope was to give students a place to start with robotics and leave the upside or potential as wide as possible. We have a few things we're working on right now that are specifically geared towards education (which we will be announcing soon!) to help make it even easier to use in the classroom." Learn more at dexterindustries.com/GoPiGo.