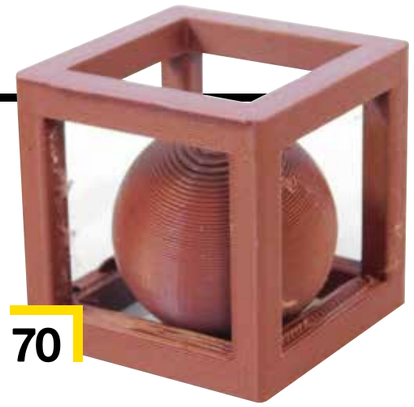
Contents



70

06 SPARK

06 **Top Projects**
Clever stuff made by clever earthlings

16 **Objet 3d'art**
An affordable family car, for tiny people

18 **Letters**
Praise for the brave cat wrangler

21 LENS

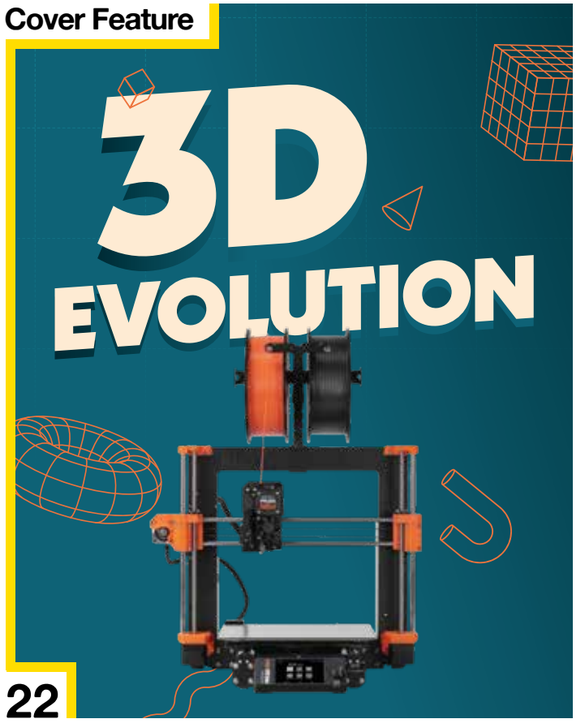
22 **3D Evolution**
Take a deep dive into the Prusa MK4

34 **How I Made:** Large Format Camera
Homemade digital daguerreotypes

40 **Interview: Josef Průša**
He's quite pleased with the Prusa MK4. Here's why…

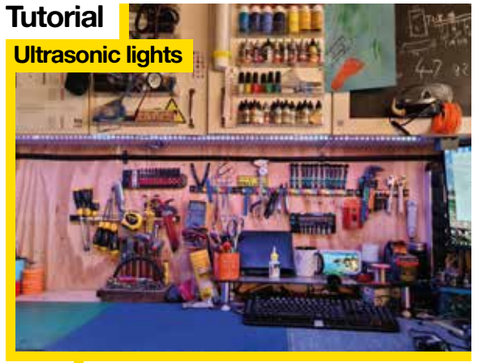
48 **In the workshop**
Chain devices together with I2C

Cover Feature



22

Tutorial



72 Add a cyberpunk feel to your workbench with NeoPixels

14

34

Tutorial

78 Force captive electrons to do your bidding

53 FORGE

54 **SoM** KiCad
Go from design to schematic on your first PCB

60 **Tutorial** NFC
Make custom greetings cards with funky electronics

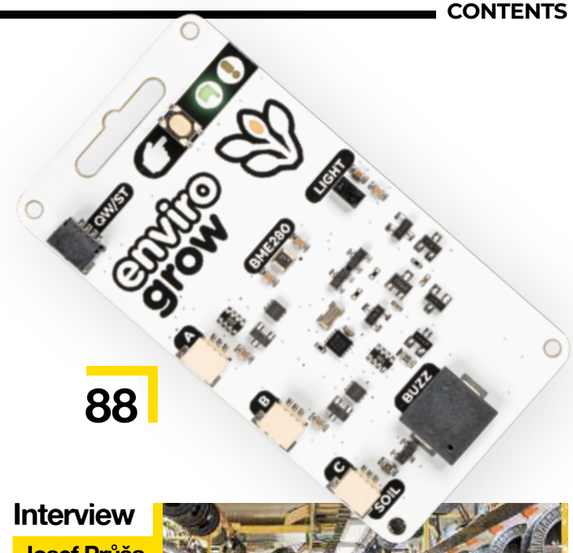
66 **Tutorial** Beginning electronics
Go back to basics with a breadboard and LED

70 **Tutorial** Print in place
Print complex parts in one go

72 **Tutorial** Ultrasonic lights
A hands-free lighting solution for your workspace

78 **Tutorial** Scooter part 2
Build a battery pack fit for a king

82 **Tutorial** ChatGPT
Can artificial intelligence design a robot chassis?



88

Interview

40 The Willy Wonka of 3D printing talks us through the magic

87 FIELD TEST

88 **Best of Breed**
Summer is on its way – get outside!

94 **Review** Pico oscilloscope
Make waves with open hardware

96 **Crowdfunding** Hoverboard
Float like a 500 lb butterfly

Some of the tools and techniques shown in HackSpace Magazine are dangerous unless used with skill, experience and appropriate personal protection equipment. While we attempt to guide the reader, ultimately you are responsible for your own safety and understanding the limits of yourself and your equipment. HackSpace Magazine is intended for an adult audience and some projects may be dangerous for children. Raspberry Pi Ltd does not accept responsibility for any injuries, damage to equipment, or costs incurred from projects, tutorials or suggestions in HackSpace Magazine. Laws and regulations covering many of the topics in HackSpace Magazine are different between countries, and are always subject to change. You are responsible for understanding the requirements in your jurisdiction and ensuring that you comply with them. Some manufacturers place limits on the use of their hardware which some projects or suggestions in HackSpace Magazine may go beyond. It is your responsibility to understand the manufacturer's limits. HackSpace magazine is published monthly by Raspberry Pi Ltd, Maurice Wilkes Building, St. John's Innovation Park, Cowley Road, Cambridge, CB4 0DS, United Kingdom. Publishers Service Associates, 2406 Reach Road, Williamsport, PA, 17701, is the mailing agent for copies distributed in the US and Canada. Application to mail at Periodicals prices is pending at Williamsport, PA. Postmaster please send address changes to HackSpace magazine c/o Publishers Service Associates, 2406 Reach Road, Williamsport, PA, 17701.