

A robotics journey

Introduction (title slide)

Hi everyone - thanks for having me on.

I'm Mike Horne. I'm one third of the organising team behind [Pi Wars](#). I'm also involved with [Cambridge Raspberry Jam](#) having relaunched it back in 2013 and I helped [Tim Richardson](#) to develop the [CamJam EduKits](#). I'm a ColdFusion developer and I mess around with SQL and databases for an educational charity. I'm based in Pottton, Bedfordshire and I'm known as "recantha" pretty much everywhere. I also run a blog called [Raspberry Pi Pod](#) which is a bit neglected these days.

So, Robotics!

Robotics is, in my opinion, one of the most fun things you can do with any electronics controller.

[slide of controllers]

You can do it with an Arduino, a Crumble, a micro:bit, and that's just naming a few. The route I've chosen to go, however, is the Raspberry Pi, because that's where my interest has settled after years of being involved with that community.

Robotics - so, where do you start?

[slide - GPIO tinkering]

The first thing you need is to get behind you some electronics tinkering knowledge or "physical computing" as it's called. This is where you use the Raspberry Pi's GPIO pins to control LEDs, switches, buzzers and other things.

[slide - EduKits]

There are plenty of places to get your electronics equipment and some great educational materials out there to get you started,

[slide of projects.raspberrypi.org]

for instance at projects.raspberrypi.org

[slide EduKit worksheet]

and also the [EduKit worksheets](#).

Moving on to robotics

After you've got used to using the GPIO pins and messing about with basic components and maybe sensors you'll then want to move on to looking at what you need for your first robotics project. But where do you start?

[slide - books/mags]

There are several books and magazines out there that you might look at - these are just a few.

[slide - kits]

Alternatively, you could go for a kit with instructions - the [EduKit](#) is (I think) really good for this, but of course it is a basic kit. Or you could go for something like [Brian Corteil's Tiny 4WD kit](#) which needs more thought putting it together. There are also other kits available on AliExpress, eBay and other retailers. Shop around and find something you like the look of, but make sure it has printed or downloadable material to go along with it to help you build.

[slide - autonomous skills]

At the end of this part of your basic robotics journey, you'll end up with a robot that you can hopefully remote control free of cables and also that demonstrates some autonomous skills such as line following and

distance sensing. You might even have managed to do some of this with a camera and image processing.

Moving on to a custom robot

Eventually, if you've enjoyed the beginners experience, you will think to yourself: I've got this nice, basic robot. What about if I want a *really nice* one? What if I want to build it in my own, customised way?

[slide - custom robots 1]

First of all, you need to visualise what you want to build.

You could go for a 4-wheeled, 4-motor robot (PiDrogen). You could go for a balance bot (pic of Faceplant).

[slide - custom robots 2]

You could go for a walking robot (Spot Puppy) or you could go for something big and crazy (MacFeeble Prime) with lots of moving parts. The choice is really up to you.

Then you will need to assemble your parts. Lots of factors to decide on here. Just a couple of which are:

[slide - motors]

Motors

- Servos - useful for exact movement but not for heavy robots - although you could get metal geared servos which will take more of a load.
- Steppers - again good for exact movement but they tend to be very slow.
- DC motors - really great for high-speed robots but not brilliantly accurate, and there are several different types, all with good and bad points.

You'll need to choose a motor controller board

[slide - mcbs]

There are several, really good motor controller boards out there.

- HATs/pHATs
 - My current favourite HAT is the [RedRobotics](#) RedBoard+. It's got so much capability to drive so many different types of motors plus has lots of other input pins. It's good value, well-made and well-used, especially by Pi Wars competitors. There are cheaper ones, though.
 - The [Explorer pHAT](#) is good, as is its bigger brother.
 - The EduKit one is pretty good but does have its limitations in terms of what it can do.
 - There's also the magnificent [ThunderBorg from PiBorg](#) which, though expensive, is rock-solid.
 - There's also the [RoboHAT and Picon Zero from 4tronix](#) which are well-designed and good for those who want functionality on a budget.
- There are also non-Pi specific boards such as those made by [Pololu](#). Some Pi Wars competitors swear by the little ones, one for each motor & wheel combination.

Look out for those makes and you can't go far wrong. Pay particular attention to something called stall current - take a look at what this is and what boards need to do to cope with it.

Power

A word about power. There are lots of options for the power source. All have their drawbacks, all have their positives. Do your research and you'll find the right one for you.

Software

This is all just hardware, of course. You then need to decide how to program the functionality. I used Python, but you can use Scratch, Rust, C, anything that can help you get at the GPIO pins.

My robot

[slide - my robot]

My robot is pretty simple, but it goes like stink, which is what I wanted. It has 4 big, rubber wheels connected to 1000 rpm motors (which I got cheap from China). I prototyped the chassis with cardboard, which was very... bendy and then Tim laser cut me the real thing out of 3mm ply.

As you can see, I'm using a RedBoard+ from Red Robotics which has an add-on that lets you monitor the battery level, which is very important as I'm using a LiPo to power the whole thing.

Conclusion

[slide - contact details]

I hope that this has given you some insight into robotics and how to get started. I'll upload my slides to my blog with links to the various products and guides so you can find everything. I'll also include links to some videos that are great guides to Pi robotics. Thank you!

Resources

[Dr Footleg's guide to robotics for beginners](#) - Paul Fretwell

[How not to build a Pi Wars robot](#) by Brian Corteil

[A talk about Pi Wars given at Electromagnetic Field in 2018](#) - Tim and Mike

[Live stream of MacFeeble Prime](#) - Keegan Neeve

[Virtual Pi Wars - lots of robotics presentations and talks](#) - various