XOR
systems

SPARK**I**NG CAREERS **I**N TECHNOLOGY

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WHY WORKING WITH YOUNG PEOPLE MATTERS

By Jeff Graham, Managing Director

Today at Xor Systems we encourage young people into science and engineering in several important ways, but the truth is our involvement has grown over the years without me really noticing. It took a close friend to point out that he saw it as something unusual, something we should be proud of. So this brochure takes a look across our activities with young people, because it is something we are proud of, and something we believe is important.

We want to introduce young people, at an early age, to the fascinating and essential world of engineering. We also get involved with science and mathematics, but the emphasis tends to be on engineering. Many parents are unaware of the breadth and range and diversity of engineering, and need help in advising their children. And most children, like much of UK society, are completely in the dark about the essential and exciting role engineering plays in all our lives, and how it interesting it can be.

One thing that fascinates me is the motivation for the many engineers I meet. I work part-time at the University of West of England and have taken part in Open Days, when the University tries to recruit youngsters to Computing degrees. It is always interesting to hear what drives the candidate to a career in computing. One young woman I know is undertaking a Robotics degree at UWE and she says that the motivation for her choosing that degree was the Iron Man movies — how exciting all the technology appears, and the endless possibilities that the Iron Man character can achieve. Does SpaceX inspire youngsters today?

I have noticed at Open Days how little the parents understand the degrees on offer, and as a result feel unable to guide their child. Their influence is often a strong one on their child's choice, and they will be hoping their child will choose a career in a safe industry, a career with prospects. But they are usually woefully lacking in knowledge of current and future technology and have no idea what areas of technology do, in fact, have good prospects. So I feel it is better to influence the child.

I have worked with youngsters at Maker Faires in Bristol, and remember a girl who wanted to become an astronaut. I stumped her when I asked her which planet she most wanted to visit. She took all day to muse on her choice and she came back to me with her answer — "Jupiter". I asked her why and she said, "Because it is so smooth, you can't see anything underneath the clouds, which makes it more interesting." She wasn't afraid of that unknown, in fact it made Jupiter more appealing and exciting.

It is that excitement that I hope to generate. By offering opportunities for youngsters in our business, where we are dealing with many interesting projects based on good solid engineering principles, we want to play our part in producing a new generation of inspired engineers ready to change the world.

AT A GLANCE

WHAT WE OFFER YOUNG PEOPLE

From inspiring pre-GCSE school children to offering year-long placements for students, we are committed to helping young people explore and understand science and technology for themselves.

FIRST LEGO LEAGUE

THE COMPETITION FOR SCHOOL CHILDREN WITH LEGO ROBOTS

Bringing *life* to technology.

FIRST LEGO LEAGUE

THE ROBOT TOURNAMENT PROMOTING A PASSION FOR TECHNOLOGY

First LEGO League is a hands on robots tournament for school children, with the mission to inspire youngsters in science and technology. It encourages young people to develop their problem solving skills, teamwork and passion about technology.

What the tournament involves?

The FLL tournament requires kids to create a robot and then solve missions with it. They have to research a topic with their team and design a solution which they present in front of the jury. They also have to present their robot design. The whole process mimics a real work environment where they will have to research, test and design a product.

This is an amazing chance for students to develop many key skills at a young age and get familiar with science and technology.

The young people do FLL as an after-school club during the year and the school buys the equipment. They get a copy of the table-top used in the competition so they can practise and plan their strategy.

The competition is split into three parts: robot game, research project and robot design.

Robot Game

For the robot game, the teams have to identify missions to solve. A strategy is needed in this part of the competition, as the teams can choose between simple and complicated missions, where the harder the mission, the more points for completing it. They have only 2.5 minutes to complete as many missions as possible.

Some teams go for a bunch of easy missions, while others tackle a handful of complicated ones. A very interesting strategy was implemented by one team this year where one of the missions required a lot of waiting time to complete, so they used this time to complete another mission and come back for it.

The robot will have to navigate, capture, transport, activate, or deliver objects. The teams have to design, build and program the LEGO robot before the competition.

WHAT A FANTASTIC WAY TO INTRODUCE CHILDREN TO SCIENCE AND TECHNOLOGY IN A WAY EVERY CHILD CAN RELATE TO - LEGO!

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Research Project

The research project develops the young people's analytical thinking and problem solving skills. As an example, in the last competition, they were required to identify a problem with a building or public space in the community and design a solution for the research project. The team present their project in a five-minute presentation.

Robot Design

When presenting their robot design, the young people show the jury how they built and programmed their robot and explain how they found the solutions for design and robot building. They have to answer the jury's questions about their robot and have five minutes for an expert conversation with the jury about the robot.

This is the part of the competition that our Managing Director, Jeff, is involved with – and it's always interesting.

How we're involved

Our Managing Director Jeff Graham is an annual judge at both the South West regional finals and the overall final, held at the University of the West of England.

Jeff has to check over the mechanical build of the robot, the software and the strategy used by the team. He loves the enthusiasm of the youngsters about technology and their passion and competitive spirit, and he is always looking for young talent.

Jeff's Experience

There's a buzz of excitement around First Lego League, in the Finals I've attended. The children have worked for months, in after-school clubs, on their robots. The age of the children ranges from Primary to Secondary to Sixth Form. The older children tend to be better at the work, they tend to have better designs and better ideas. The school will probably have invested more in the older team. However, the best session I've ever had with a youngster was 11 years old. We reviewed his software together and it turned into a code review. I've organised hundreds of code reviews professionally and this youngster was up there with the best - he could explain the code, he understood why he can chosen his approach, he knew the limitations and the possibilities. It was impressive.
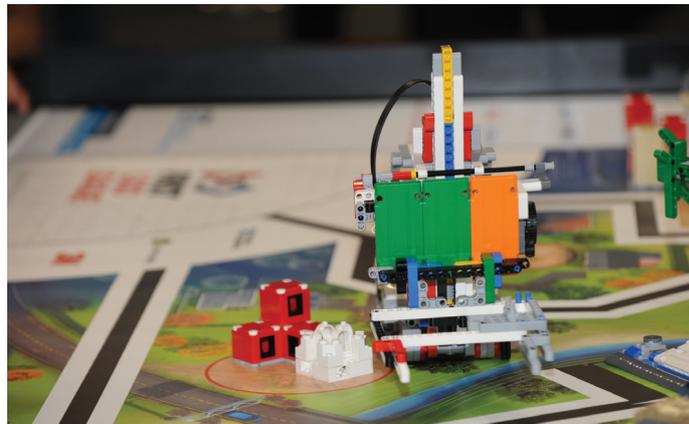
The teams tend to improve in evolutionary steps. The first year a team enters the competition, it is unlikely to lead to winning much because the team has to learn - learn how to work together, learn the technology and evolve their knowledge. So the best teams I've encountered usually have a core set of members who have been together for some time. The clever schools mix the experienced team members with new, younger members, to allow the newcomers to learn from the masters and to ensure a continuity of knowledge.

It is notable that this isn't a hard fixed rule. The winners of the England and Wales Final for 2020 were a team of girls who had entered for the very first time. They got a lot right. Girls are well represented in First Lego League, the mix of boys and girls is probably close to 50:50 and that is satisfying to see. The most competitive team I've met were the junior team from a school which tended to support the senior, all-boys team. They had the better equipment and the support of the more experienced teacher. The junior team was all girls and they had last years's hardware and a limited set of Lego. Their ambition was simple and plain - to beat the boys. This they achieved and were thrilled. Nothing else mattered!

The appeal of First Lego League for me is the challenge it presents. The teams have to solve a number of mechanical, electrical/electronic and software issues. They have to devise a strategy to solve a set of problems with their robot, some simple, some complex, some quick and some long winded. The scoring system varies per task, so the team needs to devise a scheme to let them complete the optimal set of tasks in the 2 minutes they are allowed.

Interesting strategies abound. One year, I saw a team upload code changes via Bluetooth to the Mindstorm during a mission (this has since been banned) so that the unit was ready for the next mission. Some teams use a lot of hardware such as edge detectors, line followers, gyroscopes etc. so they have greater control over the robot. Some prefer the simple and unsophisticated and aim for a smash and grab approach, throwing off missions as fast as they can and only doing simple missions.

It is fascinating to see the team in action. Only two youngsters are allowed to be in the pits and they need to perform a ballet together, preparing the Mindstorm for the next mission, adding gadgets to the robot to perform intricate manipulation. The rest of the team provide verbal support and flag waving - the team spirit is usually palpable.

The First Lego League works because of the help of the teachers. They are needed to organise the after-school club and the logistics of getting to competitions. But the majority of teachers have said to me that they don't understand much of what the youngsters do, they leave the technical detail to them. I find that strangely satisfying - this is something beyond education.
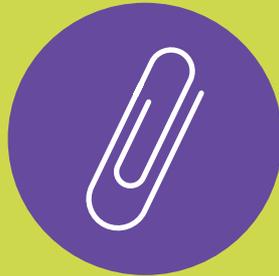
WORK EXPERIENCE FOR SCHOOL **CHILDREN**

A WEEK OF INSIGHTFUL EXPERIENCE
IN ENGINEERING AND TECHNOLOGY

Bringing *life* to technology.

WORK EXPERIENCE FOR SCHOOL CHILDREN

DISCOVERING THE FUN OF WORKING IN ENGINEERING AND TECHNOLOGY

At Xor Systems we love welcoming students from local schools, where they spend a week of work experience with us in July. It is always exciting to see young students' enthusiasm for electronics and engineering.

Jeff Graham, our Managing Director, believes it is so important for students to experience the work environment when thinking about their career path. We give the students a few projects to tackle during the week with us, and ask them to keep a diary of how it is going.

A week with our team develops young people's ability to adapt and learn new technologies while working as part of a team. We help them discover a passion for software and technology and enhance their problem-solving skills.
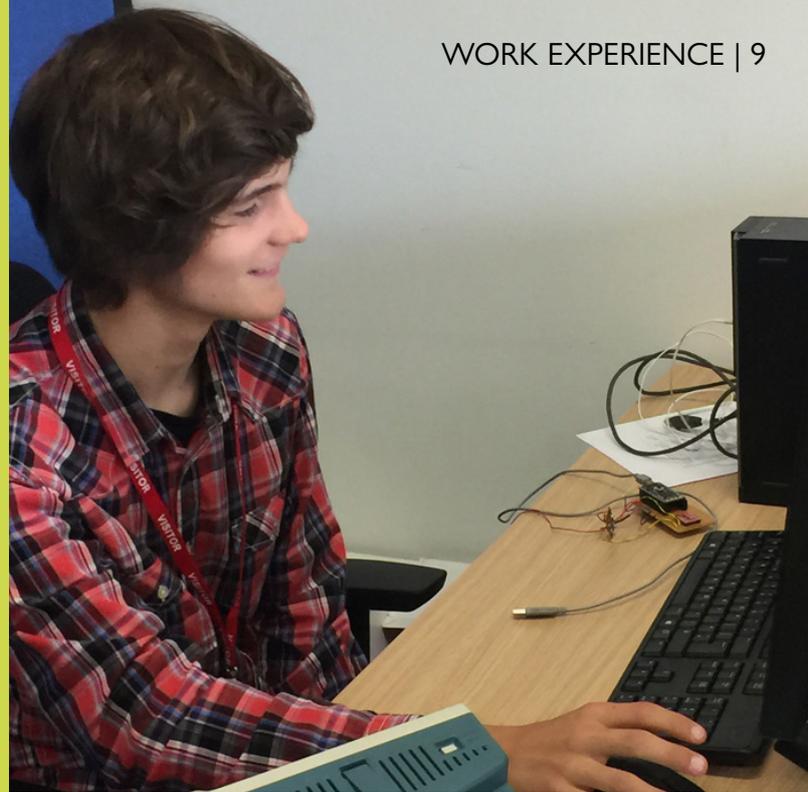
## STORIES FROM PAST STUDENTS VISITING XOR SYSTEMS

Jake

Jake's project was to solder, wire, and assemble a TI-RSLK robot and code different movements. He explored how the components are connected to the pins, and how those pins are referred to in C++. He programmed the robot to stop after one of its bump switches is activated. He also learned how to program a dimmer switch for LEDs in software.

> **Engineering clearly offers an interesting and challenging career where you get to stay at the forefront of technology. Thanks to the fantastic team at XOR, it's been a blast.**

Click to read:

Jake's Story
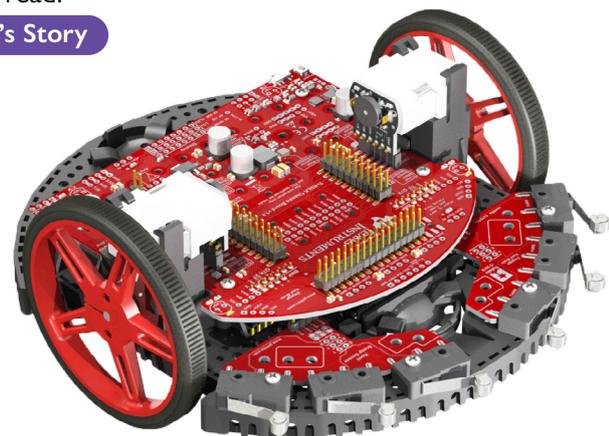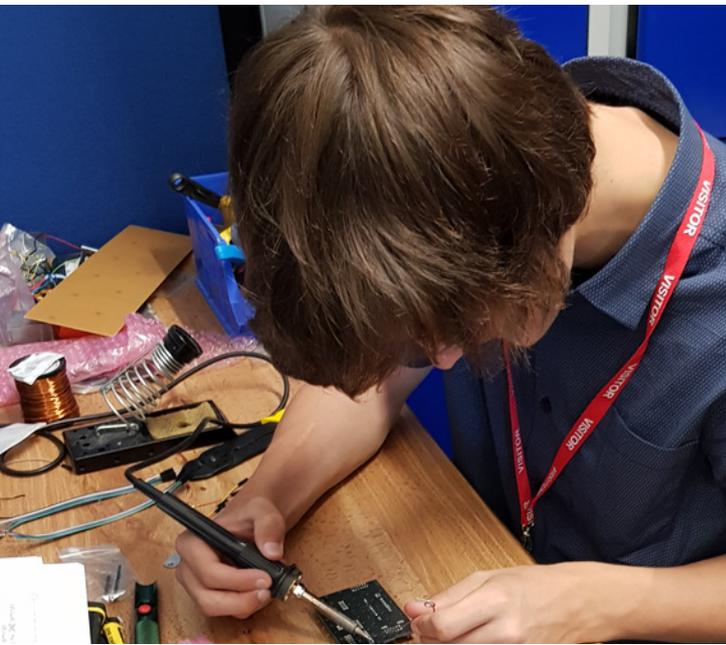
Tom

Tom worked on a Mbed NXP Lpc1768 board with tasks ranging from turning on a LED to making LEDs blink and using two buttons to turn the LEDs on and off. He managed to make the LEDs' brightness change by changing the time that they are on and off. He learned how to debounce buttons, use an oscilloscope, use the potentiometers to mix two colours together on the RGB, make the joystick light up the LEDs, and display the accelerometer readings on the LCD.

" What a week it has been! It's been very challenging but also very interesting. Before I came to XOR I knew next to nothing about C but now I know quite a bit. "

Click to read:
👆 Tom's Story

Emily

" After being treated to a lunch and my final games of ping-pong, I left feeling more confident having had a really nice and insightful experience. "

Emily's project was to learn to use the u-blox c027 board. She started off by displaying the x y and z of the accelerometer on the LCD display. She made this board send its data over to a website, using an Ariel and a satellite. She made the board share the geographical location from the GPS to the website and later to PuTTY using serials. Once she got this working we then checked how accurate it was by walking around the science park then mapping it out on a map using the coordinates collected.

Click to read:
👆 Emily's Story
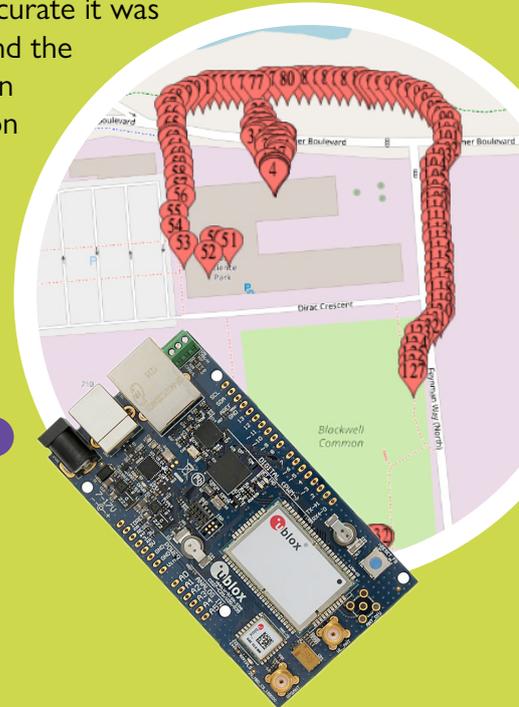
INTERNSHIP TO GAIN INDUSTRY EXPERIENCE

OUR SUMMER INTERNSHIP PROGRAMME WELCOMES STUDENTS FROM VARIOUS STEM DEGREES

Bringing *life* to technology.

INTERNSHIP TO GAIN INDUSTRY EXPERIENCE

AN OPPORTUNITY FOR UNIVERSITY STUDENTS TO DIP THEIR TOE IN A TECHNOLOGY CAREER

We are always keen to find talented young people in STEM and help them develop their skills in the field.

Our Summer Internship programme offers university students the opportunity to experience work in the industry. Our interns work independently as well as a part of a team on interesting client projects, learning new skills while doing real work for real clients.

The programme lasts three months and we welcome students from various STEM degrees, both undergraduates and postgraduates.

Students gain experience in programming, learning a variety of programming languages and environments and getting practical experience in electronics and hardware. They develop their teamwork and time management skills – and boost their employability. Above all, they gain first hand experience of a fascinating industry while working on real projects and participating in meetings first hand with our clients.

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WHAT PAST STUDENTS HAVE TO SAY ABOUT THEIR SUMMER INTERNSHIP

James

James joined us on a three-month internship from Bath University where he was studying for his MSc in Electronics System Design, having previously completed a degree at York University where he studied Electronic Engineering. He spent his time with us studying 3D localisation using UWB, building a prototype and then proving it out on a test rig.

His project went really well, with one major outcome being a demo system that we used to highlight our design skills at the South Gloucestershire Business Show. The system made it possible to move a sensor within our stand and get a readout of its 3D location.

James was also a gifted piano player and he made use of the piano abandoned in the forum at the front of the Innovation Centre.

Abigail

Abii came to work for us while studying physics at Exeter University with a focus on Astrophysics. She wanted to expand her knowledge and experience of programming and found a special aptitude in C# in a Windows environment. She loved her time working with us; so much so, she came back for another summer.

For Abii, it was a great success because the experience she gained helped her in the next year of her degree, giving her the confidence she needed for various programming tasks. She also taught us how to navigate in space, using a set of 3D coordinates.

INTERESTED IN SPENDING 3 MONTHS WITH US?

HERE'S HOW TO APPLY

APPLY ✉

Send us an email at **ask@xors.com** with your CV and the position you are applying for.

INTERVIEW 👤

If we decide you are a good match, you will be invited for an interview.

REPLY ↩

After the interview, you will get a reply in a couple of weeks.

PLACEMENT FOR UNIVERSITY STUDENTS

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AN OPPORTUNITY TO DEVELOP YOUR SKILLS IN SOFTWARE DEVELOPMENT

Bringing *life* to technology.

PLACEMENT FOR UNIVERSITY STUDENTS

HOW TO GAIN INVALUABLE REAL WORLD EXPERIENCE IN THE TECH INDUSTRY

Our Placement programme gives university students a fantastic opportunity to work in-depth on real world engineering and technology projects industry for 12 months.

The students' primary role is to assist with projects by completing secondary tasks, while observing and building an understanding of how the primary tasks are being done. Over the months, they become better programmers while experiencing a number of programming languages and environments, as well as getting to grips with electronics and hardware.

At the same time, they also develop their teamwork and time management skills, attend client meetings and boost their employability.

What makes the experience even more valuable is the fact that Xor Systems is a small, fast-moving company with a flat structure – so it's easy to get to know people across the business and learn from many highly experienced individuals.

These 12 months spent with us are an intensive, immersive crash course in the engineering and technology industry. For the right people, they are an unmissable springboard to a successful career.

Reply
After the interview, you will get a reply in a couple of weeks.
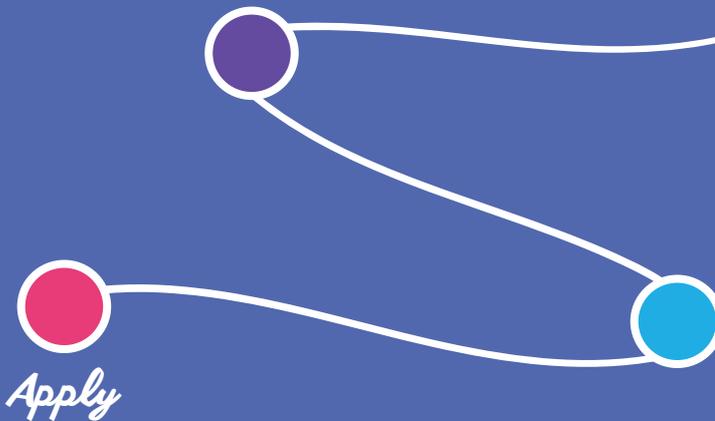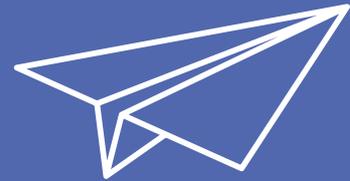
Apply
Send us an email at ask@xors.com telling us why we should be interested in having you on our Placement programme.

Meet Up
If we decide you are a good match, you will be invited for an interview.

What do you need?

We welcome students from various STEM degrees.
If you are studying Computer Science, Physics, Mathematics, Electronics Engineering, Electrical Engineering, Aerospace or another similar degree in the field of STEM, please send us an email to apply. We are looking for motivated students who are passionate about software development, and love solving problems.

What will you gain?

You will gain experience in coding and software development. You will be part of a small team and with a supervisor to help you when you struggle. You will learn a variety of skills like database management, web development, work with sensors and many others. You will always have a new challenge to help you identify what you like the most!

If you have any questions about our placement, please contact us by email.

Luke Clayton

In June 2019, we welcomed Luke for his placement year with us. He was studying BSc Computing for Embedded Systems at the University of the West of England and had just finished his second year.

Hailing from Lancashire, Luke had worked in graphic design and animation for six years for various media companies, but a growing interest in IoT devices and UI drove him to pursue a degree to work with embedded devices.

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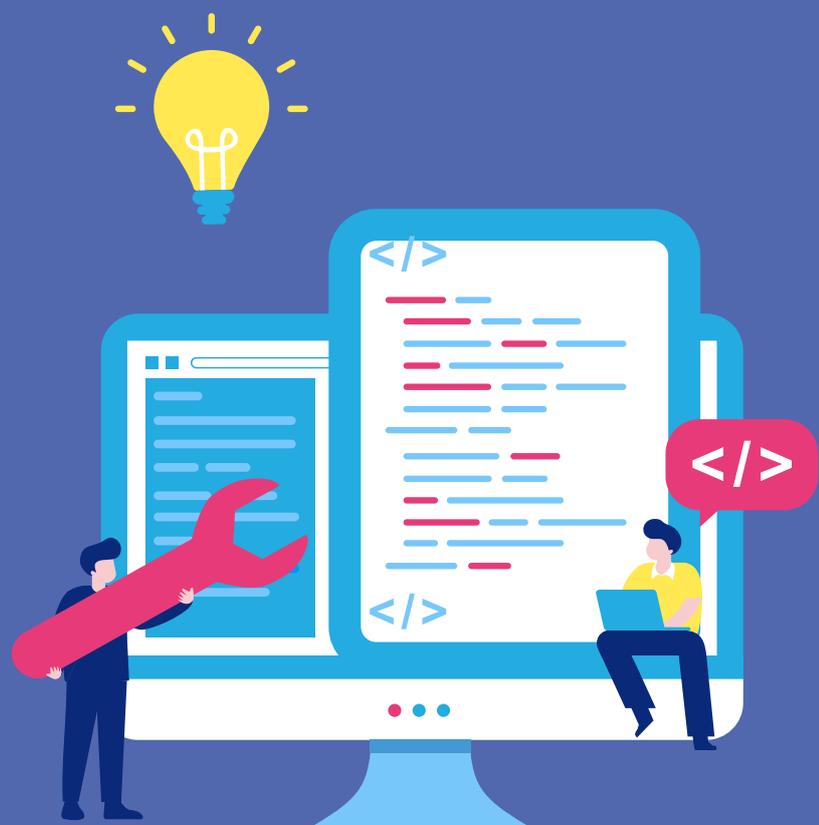
What I enjoy the most is the variety of tasks that constantly has you changing tacts to explore new challenges.

"

Luke's New Skills:

Grafana

Python

Database Management

Web Development

Networking

How to apply?

Send us an email at ask@xors.com telling us why we should be interested in having you on our Placement programme.

Q&A with Luke

What do you like the most at Xor Systems?
What I enjoy the most is the variety of tasks that constantly has you changing tack to explore new challenges, my co-workers, who are extremely helpful and supportive with any problems I face, and the nimble nature of a small team that allows for independence.

What programming languages do you use?
I use Python 95% of the time, bash scripts for the other 5%. Hopefully, some C when a current project that I am assigned to progresses.

What is your favourite moment at Xor outside of your work?
The staff BBQ! Tom, one of our software engineers, turns out to be an amazing BBQ cook and organised the whole thing, set up the BBQ, brought badminton nets and great food. We had lovely weather, on the menu were beef, lamb and veggie burgers, potato salad, and other wonderful food.

Do you receive enough help when you struggle?
I always receive help when I'm struggling. The responses are always well thought out and clear for me to interpret as I have a mild form of dyslexia, which means that I can misinterpret written instructions.

Can you give an example of a project you worked on at Xor?
A project I worked on at Xors was helping develop an emulator for a CCD spectrometer. I had to write several programs to emulate the device and its responses to instructions, read those instructions and craft hex packets depending on the current environment.

WE ARE ALWAYS LOOKING FOR NEW TALENT

This brochure has explained a little about the different ways in which we're encouraging young people to enter the world of technology and engineering. But the real reason we do this? It's because we love our work and we want others to experience it too. And because we want to play our part in developing the extraordinary and too rarely recognised achievements of the UK's engineering sectors.

So if you share the excitement that comes from creating new solutions to ever changing problems, you may be someone who should contact us – whether you're at school or university, or indeed already working in the sector and hungry for more interesting opportunities.

Above all, we want to meet curious minds. If that's you, get in touch.

XOR
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