



PULSE OXIMETER - AN ELECTRONIC DEVICE THAT MEASURES HEART RATE AND OXYGEN LEVELS IN THE BLOOD.

THE CHALLENGE

During the Covid lockdown, GX was approached by semiconductor specialist CSA Catapult to collaborate on a new STEM project to develop a Pulse Oximeter - an electronic device that measures heart rate and oxygen levels in the blood.

The UK has a shortage of engineers and needs to fill this skills gap to meet future goals. Like many engineering companies, CSA Catapult is involved in school outreach programmes aimed at inspiring students to pursue a career in a STEM subject. This project involved enlisting the support of teachers to deliver the programme, by providing them with classroom test kits and support materials that will introduce students to electronics in a practical and creative way.

The Catapult team knew what they wanted to develop, but not the finer detail of how the product should look or operate. Being involved in discussions from an early stage enabled GX to draw up a detailed specification.

A significant portion of this project took place during lockdown, which created additional challenges - teachers were busy focusing on delivering the curriculum to students remotely, and Covid-related supply chain issues threatened delays in procuring the required parts for product development.

THE SOLUTION

The Pulse Oximeter consists of a circuit board, a screen and an integrated finger pad with Velcro fastening. It uses red and infrared light sources to monitor blood flow and measure oxygen levels and heart rate. Interactivity is key to showing students how a signal is processed, with software algorithms reading and reporting on the data. Students can adjust the intensity of the light using the dials on the board and immediately see how this changes the readings on the screen.

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Iestyn Llyr,
Senior Embedded Software Engineer at CSA



PRODUCT DESIGN



VALUE ENGINEERING



CONTROL SYSTEM DEVELOPMENT

CSA Catapult were keen to 'take electronics out of the box', allowing students to see - and even touch - the components such as the micro chip and resistors, as this was something that teachers had been particularly keen on. A striking purple circuit board was chosen to appeal to students and a clear housing may be an option for the future.

THE RESULT

The device is used as a teaching aid for GCSE students to support learning about cardiovascular functionality, with its primary purpose being to show how electronics and semiconductors can be used to deliver potentially life-saving medical care.

Iestyn Llyr, Senior Embedded Software Engineer at CSA Catapult who headed up the project said; "Our goal is to introduce students from different STEM subjects to engineering. We opted for a medical measuring tool to demonstrate to biology students how electronics can be used in a medical environment. Research shows that demonstrating how engineering can be used to help care for people increases its appeal to a more diverse audience, giving us a larger pool of talent to draw from. We also liked the fact that the Pulse Oximeter uses LEDs as detectors, which could be semiconductors, as that ties into CSA Catapult's core business."

"Having the ability to turn a concept into a workable design is one of GX's great strengths," comments Iestyn. "It was one of the reasons for choosing to work with them on this project. We were also aware that the Pulse Oximeter would require thorough technology readiness levels (TRL) testing for compliance prior to production, another area that GX has expertise in."

"It's a credit to GX that we could collaborate with them virtually throughout the duration of the project - proof of how well our teams work together. It's also great to have such a positive story to look back on after such a challenging time. However we are looking forward to more in-person meetings in the final stages of development, as having everyone in the room is very beneficial for creative collaborations."

Claire Banks, Business Development Manager at GX said; "We were really pleased that CSA Catapult chose to work with us on their latest STEM project. Our teams have developed a strong working relationship which is extremely beneficial for any project. Richard Bebbington, our Mechatronics Engineer who heads up the team is passionate about his work. Clients benefit from the level of attention and energy that he puts into everything he does, something I know Iestyn and his team appreciate. We are also proud to once again be collaborating with a near-neighbour in Wales."

Twenty five prototype models of the Pulse Oximeter will be trialled in schools to allow the team to observe teachers and students using it. It will then go into production ready for distribution to schools in early 2023.

"This project was created to support the content of the biology curriculum," comments Iestyn, "once it becomes mainstream, we will look at fundraising to increase production. With plans in place in Wales to merge STEM subjects we believe it will work particularly well, incorporating aspects of electronics, software and biology, so we are planning talks with the WJEC and the Welsh Government to discuss opportunities."

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-  INDUSTRIAL DESIGN

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