

DEVELOPING THE DESIGN BRIEF

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SYNOPSIS

Following a knowledge transfer partnership with The University of Wales Trinity Saint David, it has been revealed that the chemical alcohol detector system within the existing breathalyser product range, has the potential to detect further organic materials within the breath such as virus infections. Recent laboratory testing of the prototype has proven to be successful and patent applications have been registered. Following the coronavirus pandemic, the COVID testing kit market was valued at over 70 million dollars in 2022 and is predicted to see further growth in the next couple of years, estimated to be worth over 120 million dollars by 2030 (Market Research Future, 2023). The development of a chemical detector system for this market would not only disrupt the market but would potentially add far greater value than is predicted. Therefore, it is evident that there is potential in developing a product that can meet both clinical and personal requirements for virus detection, resulting in the latest NPD project.

This document provides a design brief outlining the business adjustments required to transfer the company's existing technology, utilised in the production of alcohol detectors, to the production of devices used for virus detection. This design brief highlights the research and development requirements for this production transition and considers the technological specifications, product design, attribute details as well as the production objectives, in order to understand the requirements of the projects and the input required from various managers within the company.

New Market Potential

The new market potential for the portable virus detection system has been identified as the following:

- Personal use – when in contact with vulnerable/high risk relatives or friends.
- Access to mass gatherings - concerts, sports arenas, festivals, airports.
- Family events - weddings, funerals, christenings.
- Travel - road, air, rail and sea.
- Tourism attractions – museums, exhibitions, theme parks.
- Non-healthcare settings – Universities, schools, libraries, supermarkets, workplaces.
- Based on the above market potentials, projected sales volumes are expected to be 500,000 units in the first year, rising to 1.8million units the following year.

There are various needs that have been identified for the product which have been included and listed individually within the design brief, although, many elements are inter-related, these have been highlighted and cross-referenced for clear identification.

The design brief is a controlled document for the purpose of regulating the NPD process and a date stamp and version number is in place. Any amendments to this document must be updated with a new version number and date stamp as this document is used and updated by various departments included in the NPD process. Updated versions must be circulated amongst the NPD team members to ensure all departments are aware of any changes which may impact their input.

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AESTHETICS

Input required from: Design, Finance & Marketing Managers.

- **Colour**
 - Consistent with current company branding (same colour palette) but contrast to existing breathalyser device for easy identification of both devices.
 - Avoid offensive colours e.g., red may appear as dangerous or may have the potential to make a patient in a clinical setting feel alarmed.
 - Blue or Grey may appear too 'clinical' for personal use.
 - Green may reinforce the nature and use of the device as AQBH as it represents safety.
- **Shape**
 - Consistent with current company branding but contrast to existing product range so it is not mistaken for a breathalyser.
 - Screen, buttons and menu features all consistent with existing branding of current range.
 - The shape of the handheld piece should be contoured to the hand for maximum comfort when using for increased duration such as mass crowd testing.
- **Finish**
 - Smooth finish with durable coating that can withstand regular application of cleaning agents and disinfectants (no peeling).
 - Splash proof and dust proof.
- **Touch**
 - Touch screen for optimum cleaning.
 - Avoid buttons where possible due to hygiene risks.
 - Soft touch/gel padded handheld piece for increased user comfort.
- **Audible**
 - Alert operator when testing starts and completes, when software updates are required and when battery is low.
- **Compatible Accessories**
 - Universal android type charger.
 - Sample tubes/mouthpieces – specifically designed for the device providing an easy fit pressure tab.
 - Wrist strap to prevent operator dropping the device.
 - Leather pouches – to provide additional protection.
 - Calibration equipment – dry gas.
 - Silicon skin protective cover.

Cross References

- Standards and specification - IP65 compliance for splash and dust proof enclosures/screens. MHRA guidelines.
- Ergonomics - Shape and feel.
- Finance - Impact of colours, finishes will have an impact on final cost per unit.
- Branding - colours and shape.

BRANDING

- **Colours**
 - Brand colours – use of existing brand colours will help build brand recognition and consistency with existing product lines.
 - Colours, shapes and font to be consistent with company branding strategy.
- **Logo**
 - Consistent logo usage to help build brand recognition.
 - Brand guidelines to include logo variations such as colour variations and logo formats and when to use each variation e.g., demonstrate correct logo usage on different backgrounds such as patterned or different colours.
 - Localisation guidelines – to accommodate new markets a localised logo may be required which will accommodate languages that read right to left (which changes the placement of the logo on the packaging).
 - Logo on device start up and shut down screen as well as accessories.
 - Virus detector device to be included in the brand guidelines.
- **Imagery**
 - Visual designs to communicate brand identity.
 - Product photography to be arranged following the first run in preparation for digital marketing and ecommerce material.
- **Brand Voice and Tone**
 - Promote a brand voice that is relatable, genuine, inclusive, approachable, and informed (Duberg, 2023).
 - Written, audio, and video content achieves a consistent voice and style for the marketing of all product lines.

Cross References

- Competition – Marketing strategies.
- Aesthetics – colours, shapes.
- Company Constraints – financial impacts of branding options.
- Packaging – packaging materials consistent with branding.

COMPANY CONSTRAINTS

Finance

- Instruction from CEO and Finance Director to drive down the manufacturing costs.
- Finance production and company growth simultaneously.
- Check eligibility and apply for government funded schemes.
- Bank support and loans.
- Finance for expansion of production facility including storage, workbenches for assembly and production lines.
- Sourcing and purchasing of raw materials.
- Sourcing and purchasing of machinery and tools e.g., change parts for the line.
- Knowledge transfer partnership with local University.
- Extra staff.
- Extra overheads if extending production hours to meet targets.
-

Time

- Strict timeline.
- Urgency to bring to market following the coronavirus pandemic.
- Restricting R&D.

Technical and Functional

- Screen size – small device, small screen which will limit the font size on the display screen.
- Power – increased battery capacity, essential for testing large events (mass gatherings).
- Applications – for data upload, components need to be suitable for android applications.
- Integration – data back up (such as cloud), app connection, GPS technology.

Design

- Available components.
- Lead times from suppliers.
- Brand guidelines.

R&D Development

- Staff development
- Upskilling of workforce (if sourcing mouldings separately and assembling in house).
- Develop relevant work instructions and SOPs to ensure staff are manufacturing the product to a specification, ensuring consistency.
- Utilise students through knowledge transfer partnership.

Cross References

- Performance – impact on design and technical functions.
- Ergonomics – impact on costs and design.
- Sustainability/Circular Economy – materials used.

COMPETITION

- **Competitor Analysis**

- **Manufacturing** – It will need to be determined how our competitors are manufacturing their products. A product teardown should be performed to identify the type of circuit board used by competitors and whether it is sourced fully assembled and tested or assembled in house. Evaluate the design and make improvements. Research the challenges faced by competitors and identify possible routes of shortening the time to market.
- **Supply Chain** – identify where competitors are sourcing their materials and any roadblocks they may have encountered, to ensure the planned materials are available to source. If alternative materials are used by competitors, research to understand why this is.
- **Customer Feedback** – Review customer feedback on competitors' products to understand whether there is an unmet need, leading to future opportunities.
- **Review IP Landscape** – Expired patents may contain solutions or ideas which are free to use. Understand whether competitors filed any patents and if any have expired. Identify new opportunities and ideas.
- **Unique Value Proposition** – Find market advantage and develop products that will challenge competitors.

Cross References

- Aesthetics – alternative design to competitor's products.
- Branding – marketing focused on unique value proposition.
- Performance – performance requirements will be influenced by competitor analysis.
- Packaging – supply chain.
- Materials – Supply chain.
- Intellectual Property

DOCUMENTATION

- **Instruction Manual**
 - Illustration of device.
 - Important safety information.
 - Contents including accessories.
 - Display symbols.
 - Instruction on how to use the device.
 - Error messages and troubleshooting.
 - Maintenance and storage instructions.
 - Specifications.
 - Warranty information.
 - Manufacturers declaration.
- **Calibration Test Certificate**
 - ISO9001 – traceable record of calibration for finished products.
 - Calibration frequency recommendations specific to application e.g., any differences between clinical use and personal use.
 - Certificate must be from a UKAS accredited laboratory.
- **Supplier Documentation**
 - Request supplier accreditation and certificates to ensure use of reputable suppliers.
 - Specifications of materials supplied.
- **Quality Documentation**
 - Product specifications.
 - Evidence of quality checks.
 - Traceability documents.
 - Product codes.
 - Goods in checks.
 - Certificates of authenticity.

Cross References

- Legislation and Legal – documentation must be compliant with relevant legislation.
- Standards and Specification – Accreditation for appropriate standards.
- Packaging – labelling and documentation requirements.
- Materials – Specifications for supplied materials.

ERGONOMICS

- **Safety**
 - Side exhaust system to reduce operator exposure to breath.
 - Disposable mouthpiece.
- **Comfort**
 - Contoured handpiece – universal hand (can be used left or right-handed, not excessive contour).
 - Gel handpiece.
 - Mouthpiece to have wide-bore lipped end for ease of use (in line with current mouthpieces for breathalyser).
 - Size – device is small enough to be held and used in one hand.
 - Wrist strap for use when operating or carrying device.
- **Grip**
 - Operation with either hand.
 - Room for finger grips.
 - Designed for operating with wrist straight.
 - Rounded edge grips and texture.
- **Display**
 - Large enough area.
 - Large font to allow characters and data to be easily readable.
 - Back lit for ease of use in dark environments.
- **Alarms**
 - Audible alarms loud enough (low power, faults, positive result etc.).

Cross References

- Aesthetics – feel and shape.
- Regulations – safety.
- Performance – features designed for ease of use.
- Company Constraints – finance.

ENVIRONMENT

- **Weather**
 - High temperatures - For use in hot countries such as UAE. Heat switches or thermal transistors. Must be nanoscale for a small handheld device.
 - Low temperature – built in heater ensuring readings at sub-zero temperatures.
 -
- **Corrosion**
 - Consider using volatile corrosion inhibitors (VCI), Transmitters or rust/tarnish prevention capsules depending on the type of circuit used.
- **Shock and Vibration**
 - Use proprietary, thermoset, polyether-based polyurethane material with viscoelastic properties as a shock absorption material.

Cross References

- Standards and Specifications – temperatures.
- Testing – Environmental testing.
- Materials – Environmental factors limit material usage.

INTELLECTUAL PROPERTY

Consult a patent attorney for advice on IP.

- **Reasons to apply for a patent:**
 - Protect and attract investment.
 - Prevent unfair competition.
 - Reduce risks for investors.
- **What needs protecting:**
 - Brand (Logos, product name etc) - registered design, trademark, copyright.
 - Software – Copyright, database right, confidential information.
 - Products (Invention and design) – Patent, registered design, confidential information.
 - Marketing materials – Registered design, trademarks.

Cross References

- Branding – market intelligence.
- Competition – Review IP landscape.
- Performance and Design – influenced by IP.
- Company constraints – finance, relationship with involved university.
- Legislation and Legal – Compliance and legal aspects.

LEGISLATION AND LEGAL

A legal representative will be consulted to ensure the product complies with appropriate legislation to ensure the legality of the product.

Cross References

- Intellectual Property – advice on copyright, trademarks, patents etc.
- Standards and Specifications – compliance with relevant standards.
- Testing – testing requirements and methods.
- Packaging – labelling requirements.

MANUFACTURING FACILITIES

- **Capacity**
 - Required capacity from production line for projected volumes of 750,000 in Year 1 and 3 million for year 2 onwards.
 - Ensure sufficient storage for the raw materials and finished product.
 - Ensure sufficient space for additional staff within the production areas.
- **Equipment**
 - Ensure existing line is suitable for production of the new product, make necessary modifications and source required change parts.
 - Existing facilities must have sufficient space/workbenches for in house assembly of the mouldings. If not, pre-assembled units must be sourced.

Cross References

- Packaging – equipment and storage.
- Standards and specifications – facilities must meet the standards of accreditation.

MATERIALS

- Seals, gaskets, and mouldings – silicon rubber, used to hold the air and move it in the right direction of the sensor. The flex and hardness of the seals improves accuracy.
- Electronic circuit boards.
- Moulded casing of plastic composition.
- Shock absorption materials.

Cross References

- Ergonomics – specific materials used for comfort e.g. gel handle.
- Weight – lightweight materials used.
- Packaging – fragile materials require specific packaging and labelling.
- Testing – different materials will have varying test results.

PACKAGING

- **Physical Protection**
 - Packaging must protect against vibration, shock, high temperatures, low temperatures.
 - Handling information on outer packaging such as 'FRAGILE', 'HANDLE WITH CARE' or 'THIS WAY UP' for protection of the product throughout handling and distribution.
 - Consider corrugated paper, foam, bubble wrap as means of absorbing impact during transit.
 - Consult specialist packaging manufacturers for advice on specifically designed packaging.
 - Mouthpieces individually wrapped in hygienic wrappers to reduce risk of contamination.
- **Information**
 - Regulations met.
 - How to use the product.
 - Transportation guides.
 - Recycling and disposal instructions.
 - Power supply information.
 - Colour codes quality control labels to indicate quality checks have been carried out.
- **Marketing**
 - Packaging and labelling to encourage potential buyers to purchase the device.
 - Sharp images and product information.
 - Product graphic designs.
 - Imagery of product in use.
 - Consider 'White box' packaging for ecommerce sales to reduce cost/unit.
- **Convenience**
 - Material - ease of disposal (reuse/recycle).
 - Weight – ease of handling, stacking and carrying.
 - Shape/measurements – ease of handling, storing, and displaying.
 - Primary packaging to be compact for ease of use in space restricted areas.
- **Security**
 - Tamper resistant.
 - Tamper evident features.
- **Equipment**
 - Strapping tools.
 - Pallet wrapping machines.
 - Tape dispensers.

Cross References

- Sustainability – materials used.
- Environment – physical protection of product in high or low temperatures.
- Manufacturing facilities – available equipment.
- Finance – budget will influence packaging type.
- Standards and specifications – must comply with packaging regulations.

PERFORMANCE

- **Power**

- Power unit at rear of device holds 4 x AA batteries, enough power for 8,000 breaths (depending on operating conditions).
- Optional extra for rechargeable battery (must be specified at time of ordering).
- If using a device with rechargeable battery, when the low power warning displays, there will be enough power for 50 further breath tests (depending on operating conditions).
- The unit can be recharged using mains or 12 volts DC, using appropriate charger supplied.

- **Features**

Optional extras:

- GPS tagging.
- Time.
- USB type C.
- Rechargeable battery.
- Bluetooth.
- App connection.

Standard features:

- Illuminated sampling port.
- Fast, accurate and clear readings.

Cross References

- Ergonomics – Ease of use.
- Standards and specifications – power specifications.
- Aesthetics
- Company constraints – Finance.
- Testing – performance will be put under pressure during product testing, outcome may change performance requirements.

SAFETY

Safety of the product will be guaranteed as it is made to specification and to relevant standards. Consultants to advise.

- Quality checks to be completed in line with safety standards and regulations.
- Standard Operating Procedures (SOPs) and work instructions to be developed for production staff to follow to ensure consistency and compliance.
- Audits – manufacturing facilities regularly audited and inspected by internal and external auditors.
- HSE – business is registered with HSE and procedures are in place to safeguard staff and products.
- Anti tamper packaging.
- Side exhaust fitted for the safety of the operator.
- Labelling – safety labelling and warnings for batteries.

Cross References

- Standards and specifications – label compliance.
- Documentation – user manual and specifications included.
- Packaging – tamperproof packaging to guarantee product authenticity.
- Performance – side exhaust.

SHIPPING AND DISTRIBUTION

- Haulier contracts - Get contracts in place inline with sales forecast.
- Distributors – utilise existing distribution networks.
- Ecommerce – ensure contracts in place to meet delivery requirements (next day, delivery 2-3 working days etc.).
- Build relationships with suppliers, hauliers, distributors, utilise existing networks where possible.
- MOQ – base MOQ requirements on capacity to ensure demands are met.
- Logistics – complete and ship orders going to same/similar locations at the same time.

Cross References

- Packaging – packaging type variations for large- and small-scale orders.
- Manufacturing facilities – suitable capacity and equipment for loading haulage companies at warehouse. Suitable MOQs.
- Company Constraints – Relationship building/networks.
- Sustainability – effective logistic management.

STANDARDS AND SPECIFICATIONS

- **Standards**

The below is an indication only of the UK standards that will need to be considered, the internal compliance officer is to seek the advice of a legal professional.

- Conformity assessment for UKCA – Must comply with the Medical Devices Regulations (UK MDR, 2002).
- MDR Part - requirements for relevant part must be met.
- Consumer Protection Act 1987 – to ensure safety for intended use.
- Medical device classification category – determined through MDR (2002) (Accessories are classified separately).
- Post-marketing monitoring and surveillance to be carried out by the company and reported to The Medicines and Healthcare Products Regulatory Agency (MHRA) in the case of any adverse incidents.
- Any claims relating to the product accuracy may require a clinical investigation, MRHA will need to be notified.
- FCC
- Point of care test device (POCT) when used in clinical settings (Small analyser classification).
- Meta-analysis to determine detection accuracy.

- **Specifications**

- Model number.
- LCD digital display.
- Measurement range.
- Accuracy (calibration test certificate).
- IP Classification.
- Power source – 4 x AA batteries.
- Battery life - Approximately 8,000 breath tests using 4 x new AA alkaline batteries.
- Sensor type – Electrochemical fuel cell.
- Measuring range – 0.0 to 3.0 mg/L BrAC.
- Operating temperature: 10°C - 40°C.
- Operating humidity: 15-90% RH.
- Operating air pressure: 700 – 1060 hPa.
- Storage temperature: -20°C - 60°C.
- Storage humidity: 10-95% hPa.
- Storage air pressure: 700 – 1060 hPa.
- Weight of device: 325g (including batteries).
- Dimensions of device: 210mm x 75mm x 45mm.
- Dimensions of sample tube: 0.5" (w) x 2" (l).
- Memory: 50 readings.
- Notes on clinical validation studies.
- Bluetooth – Optional extra.
- App connection – Optional extra.
- GPS – Optional extra.
- Warranty – 12 months, parts and labour.

- Calibration standard – Dry gas or virus breath liquid simulator.
- Calibration adjustment – 12-month calibration stability approved. Calibration check once a month and calibrate every six months.

Cross References

- Ergonomics – specifications based on users needs.
- Documentation – Specification to be in user manual.
- Packaging – mandatory information from specifications and standards to be included on the packaging.
- Performance – specification based on performance requirements.

SUSTAINABILITY

- **Packaging**
 - Avoid mixing two types of polymers on packaging to ensure packaging is recyclable.
 - Reduce the amount of packaging.
 - Sterile and easily recyclable materials – e.g., card.
- **Suppliers**
 - Develop relationships with reputable suppliers.
 - Use the '10 C's' as a sustainability-driven, decision-making tool when committing to supplier contracts (Dobinson, 2023).

The 10 C's

1. **Competency:** Their track record of success.
2. **Capacity:** The size of orders they can handle.
3. **Commitment:** Their commitment to you and to standards of quality.
4. **Control:** Their control over their own processes and supply chain.
5. **Cash:** Their financial strength, including liquidity and positive cash flow.
6. **Cost:** Their prices compared to similar suppliers' prices.
7. **Consistency:** Their ability to produce the same products and quality repeatedly.
8. **Culture:** Their core values.
9. **Clean:** Their care of people and the environment.
10. **Communication:** Their quality and methods of communication.

(Dobinson, 2023)

- Identify supplier's standards of sustainability via supplier questionnaire, request their sustainability policies, review and approve.
- Use local suppliers where possible.
- Utilise the same suppliers for both products (breathalyser and virus tester).

- China and Malaysia are most favourable suppliers of the electronic circuit board –China is an overall ‘greener’ country than Malaysia with a better focus on sustainability and is making moderate improvements with their sustainable development goals (McClelland, 2023), favouring Chinese suppliers over Malaysian when it comes to sustainability.
- Opting for UK suppliers over European suppliers for the moulded parts would help reduce the supply chain and carbon footprint.
- **Materials**
 - Use of lightweight packaging materials to reduce CO2 emissions, transport and packaging costs.
 - Request volatile organic compound (VOC) free inks for printing of packaging materials.
- **Accreditation**
 - Implement ISO14001 within the business – environmental management system.
 - Request copies of supplier accreditation to keep on file.
 - Work with accredited suppliers.
- **Operations**
 - Replace Paper documentation for electronic file management and cloud computing to reduce production of VOCs and greenhouse gases into the environment.
- **Web Design**
 - Produce printer friendly versions of web pages and marketing materials which avoid coloured backgrounds and large font which could extend over more pages to reduce ink and paper usage.

Cross References

- Materials - use of fragile materials within the device may determine the material/volume of packaging required.
- Branding - colour and material of packaging to be in line with current company branding.
- Weight – the weight of the device may determine the material of the packaging used.
- Standards and specifications.
- Environment.
- Packaging – ease of disposal and packaging information.

TESTING

- **Mechanical Shock**
 - Carry out test without carrying case.
 - Place instrument on rigid surface in normal attitude, raise each lower edge in turn and allow instrument to fall freely onto the surface (raise by 25mm maximum inclination of 30°).
 - Follow by function test.
- **Functional Test**
 - Two complete measuring cycles in metrological test mode.
 - Permissible error ± 2.0 g/100ml from the expected value.
- **Temperature, Pressure and Humidity**
 - Place instrument in test chambers to mimic the minimum and maximum temperatures, pressures and humidities specified.
 - Or complete a Damp Heat (Cyclic) test with the power off to induce condensation.
- **Vibration**
 - Carry out test without carrying case.
 - The instrument shall be subjected to vibration on 3 perpendicular axes in turn with a swept range of frequencies from 10Hz to 150Hz at 1 octave per minute, and an RMS acceleration of 1.6m/s².
 - Follow by function test.
- **Shaking**
 - To simulate the effects on an instrument in transportation of a vehicle.

Wave shape: Sinusoidal
Acceleration: 10g ($g = 9.81\text{m/s}^2$)
Duration: 6ms Frequency: 2Hz
Number of axes: 3 perpendicular
Number of shakes: 100 per axis

- Follow with function test.

- **Blown Dust**
 - To simulate the effects of atmospheric dust on the operation of the instrument.
 - Instrument to be placed in test chamber with dust or sand at a specified velocity.
 - Follow with function test.
- **Water Resistance**
 - To simulate effects of spray or rain during use or transport.
 - Method Ra1 - Artificial Rain in BS EN 60068-2-18:2001, IEC 60068-2-18:2000 - Environmental testing.
 - Follow with function test.

Cross References

- Performance – testing confirms whether performance requirements have been met.
- Standards and specifications – testing confirms if standards have been met and defines the specifications for the product.

WEIGHT

- Must be light enough (<4.4kg) to carry for at least 10 minutes without resting (Handheld, portable device).
- <2.3kg for use when holding away from body (testing someone else).
- Sturdy enough to absorb impact without sustaining damage.

Cross References

- Packaging – weight will affect type of packaging materials used.
- Ergonomics – weight will affect the comfort and ease of use of the product.
- Standards and specifications – specifications include the weight of the product. Must meet relevant standards.
- Testing – weight will affect, shock and vibration.

References

- Brown, M. and Hand, R. (2023) *12 awesome examples of Ergonomic Product Design*, Cad Crowd. Available at: <https://www.cadcrowd.com/blog/12-awesome-examples-of-ergonomic-product-design/> (Accessed: 20 May 2023).
- Business Victoria (2023) *Sustainability in graphic and web design*, Business Victoria. Available at: <https://business.vic.gov.au/business-information/sustainability/sustainability-in-graphic-and-web-design#:~:text=The%20size%2C%20shape%2C%20colour%2C,efficient%20use%20of%20natural%20resources.> (Accessed: 20 May 2023).
- Danone (2017) *Designing the products to meet environmental challenges is possible and needed*, Medium. Available at: <https://medium.com/@Danone/designing-the-products-to-meet-environmental-challenges-is-possible-and-needed-3f251d912420> (Accessed: 20 May 2023).
- Dobinson, K. (2022) *5 ways to be a more sustainable business*, Sage Advice United Kingdom. Available at: <https://www.sage.com/en-gb/blog/ways-more-sustainable-business/> (Accessed: 20 May 2023).
- Duberg, O. (2022) *What are brand guidelines? (how to create & 5 examples)*, Frontify. Available at: https://www.frontify.com/en/blog/brand-guidelines-everything-you-need-to-know/?utm_term=&utm_campaign=%5Bn%3Agsn%5D%5Bg%3Auk%5D%5Bl%3Aen%5D%5Bt%3Aadsa%5D%5Bc%3Aproduct%5D%5Bs%3Abrand_guidelines%5D&utm_source=google&utm_medium=cpc&hsa_acc=3442913945&hsa_cam=16804750277&hsa_grp=138262315347&hsa_ad=591559629347&hsa_src=g&hsa_tgt=dsa-1653432703657&hsa_kw=&hsa_mt=&hsa_net=adwords&hsa_ver=3&gclid=Cj0KCQjwmZeJBhC_ARIsAGhCqndEjpnnsJXFEB-TnOQPtGWbP0yej17dKviqwrJpMNIcMg7T5uLQTRkaAkRwEALw_wcB (Accessed: 20 May 2023).
- Ergonomics of Handheld Devices for Industrial Use (2004) *Ergonomics of hand-held devices for industrial use*. Available at: http://www.processforusability.co.uk/PIC54webslides/Slides/Ergonomics_of_hand-held_devices.htm (Accessed: 20 May 2023).
- Gimondo, J. (2023) *5 ways to leverage your competition in new product development*, M3 Design. Available at: <https://www.m3design.com/new-product-development-competitive-analysis-strategies/> (Accessed: 20 May 2023).
- GOV.UK. *Medical devices: How to comply with the legal requirements in Great Britain* (no date) GOV.UK. Available at: <https://www.gov.uk/guidance/medical-devices-how-to-comply-with-the-legal-requirements> (Accessed: 20 May 2023).
- Green Match. (2023) *The world's greenest countries 2023*: GreenMatch.co.uk. Available at: <https://www.greenmatch.co.uk/blog/greenest-countries> (Accessed: 20 May 2023).
- lion laboratories (2018) Available at: <https://www.lionlaboratories.com/wp-content/uploads/2020/08/500-Mk-IV-RM50737-Rev-3.pdf.pagespeed.ce.1aNoA6yvvG.pdf> (Accessed: 20 May 2023).

Market Research Future (2023), Global COVID Testing Kit Market [Online]

Prabhu, S. (2021) *Controlling corrosion in electronic devices*, *Corrosionpedia*. Available at: <https://www.corrosionpedia.com/controlling-corrosion-in-electronic-devices/2/1478#:~:text=To%20prevent%20corrosion%2C%20copper%2Dbased,to%20be%20in%20good%20condition.> (Accessed: 20 May 2023).

Simpson, A. (2023) *Calibration: Testing times for instrument accuracy*, *Med*. Available at: <https://www.med-technews.com/medtech-insights/medtech-materials-and-assembly-insights/calibration-testing-times-for-instrument-accuracy/> (Accessed: 20 May 2023).

UXPin (2023) *7 constraints in design and how to overcome them*, *Studio by UXPin*. Available at: <https://www.uxpin.com/studio/blog/constraints-in-design/#:~:text=With%20UXPin%20Merge-,What%20are%20Design%20Constraints%3F,these%20limitations%20before%20every%20project.> (Accessed: 20 May 2023).

Zerust Rust Prevention (2022) *Preventing electronics corrosion on computers, integrated circuits, and microchips*, *Zerust Rust Prevention Products*. Available at: <https://www.zerustproducts.com/rust-prevention-tips/preventing-electronics-corrosion-on-computers-integrated-circuits-and-microchips/> (Accessed: 20 May 2023).