Project Guide

Design Problem and Design Brief

Design Problem

This is the first page and you must introduce your project here. First write about the problem - e.g. if you are designing an alarm think about.

- Who needs the alarm?
- Why are alarms needed?
- What are they protecting?
- Where is the alarm to be used?
- Who will respond to the alarm?
- How will it be noticed - sound, lights, etc.
- Reliability and maintenance.
- How is it to be powered - mains, batteries, solar etc.
- Security in general.
- How people are affected if their property is damged or stolen.

Now write about these points in your own way. Include examples from your own experience. A good way to start is imagine that alarms had never been thought of and describe what would happen to all your precious possessions without security..

The Design Brief

This is where you write a short statement of intent. - ***I am going to design and make an alarm which will be used to protect my ------ (shed/bedroom/house/garage/bike etc.)***

You could write more in this section but the specification is where you will write all the details.

Task Analysis

Write the name of your project in the centre box.

Write keyword questions in the other boxes.

- Who is it for?
- Function - what does it do/what is it for, how does it operate?

- What materials are available?
- What components are available/needed? - Electrical,electronic, mechanical.
- What size should it be? Anthropometrics?
- Ergonomics - comfortable to use?
- Portable/Fixed in place? Where will it be put.
- Does it need to be stored?
- How much will it cost to make/ how much would it be sold for in a shop?
- Time? - How long will it take to make?
- Colour scheme/finishes?
- Construction methods that could be used?
- Are special fixings or fittings needed such as hinges, locks, security screws?
- Are there any safety issues - e.g. electrical.
- Any special machines or techniques that could be used in the production?

Add extra arrows and boxes if you need them.

These are the questions you must answer by doing research and by making decisions.

Research - Existing products

Stick a picture of a product that is already in the shops, catalogues or internet in each box. Get these pictures from catalogues or better still from the companies websites. e.g. ***(This Page could be done using XaraX or MS Word by cutting and pasting straight from the internet into the page)***

ADT alarms

British Gas Alarm Systems

BT Alarms

Powerzone Electronics

Rapid Electronics

Write three good points and three bad points for each picture.

Good points could be:

- price - affordable for the client,
- functions (works) effectively,

- easy to use,
- useful features,
- easy to fit into place,
- suitable for the client because -?.

Bad points could be :

- too expensive, too cheap
- made from wrong materials - not tough enough,
- too heavy or too large,
- unattractive
- hard to fix into place,,
- not strong enough for its intended use
- not enough features,
- hard to use.

In the summary box write a conclusion - what you now think about the products you have looked at. Use a mix of the good and bad points to help you write this summary.

Research - Materials, Components and Fixings

In the first table list all the **materials** or components that you could use in your designs. e.g. 6mm plywood, flexy ply, MDF, acrylic sheet, HIPS, aluminium, brass, mild steel, switches, sensors, pic chips, mechanisms, motors etc.

For each material describe its properties such as function (what it does), strength, density (weight), easy to work, tough, hard, flexible transparent etc.

In the last column say what the possible use could be - such as making the case, handles, feet, sensor unit, mechanism etc.

In the **Components** Box cut and paste or hand sketch pictures of any components that could be used in your designs. Then at the bottom explain how these materials and components could be used in your project e.g.

- an LED could be used to indicate that the alarm is on,
- a siren could be used as the warning of intruders etc.
- a switch can be used to turn power on and off.
- HIPS could be used to vacuum form the case,
- acrylic could be laser cut to make the mechanism.

In the Adhesives and Fixings box again sketch or cut and paste a range of fixings and fastenings which could be used in your designs. Hinges, a range of screws, nuts and bolts, nails and pins. Include - Tensol cement (for acrylic) and Araldite(2 part epoxy resin can glue almost anything!). Superglue which is also effective on a wide range of

materials.

Label everything and say what they could be used for. e.g. M4 nuts and bolts could be used to hold the operating lever in place.

You can add extra headings on these sheets to suit your project

Research - Questionnaire and Interviews

The questionnaire is a multiple choice - So under QUESTION write a question such as what would you use an alarm to protect or how much would you pay for an alarm system. Liist as many alternatives as you want (at least four). Tick the choice under each of your friends names that you have written across the top. The totals can be used to produce a pie chart or bar chart (this is very easy to do in Excel).

Interview two people - ask questions about the design problem, how they would use the product, cost they would pay, would they buy it for someone else, does it need to be portable, when,where and how would they use it, how strong does it need to be etc.

The summary section is used to represent what you have found out. From my surveys I have found out that, most people prefer ---, but some people ----, I was surprised to discover that ------! etc.

Research Summary

Stick pie charts and/or bar charts, produced in a spreadsheet such as EXCEL, in the box. ***This will be evidence for the effective use of ICT skills.***

In the Box titled - **HOW MY RESEARCH HAS INFLUENCED MY DESIGN DECISIONS -**write an overall conclusion. You can repeat anything you have already said. You can also write this later when you have finished your project and have had time to reflect. This section will help you write the **SPECIFICATION.**

Specification

List all the features which your design will have.

Then for each point say why it is important for your design.

Examples of specification points and reasons - using an alarm as the example:-

Must be safe in use	It must be finished with non toxic products. No sharp edges or rough areas that could cause injury. Electrically safe, mechanically safe. No trapping of hands or fingers. Securely fixed as it could cause injury if they fell onto a hand or foot.
Must function	Act as a deterrent to theft or damage.
Must be attractive - aesthetically pleasing.	The design must be suitable for its environment (where it it is used). Marketable quality.
Must be cost effective.	The client must be able to afford the product if it was to be manufactured. It must not use excessive amounts of material. Estimated materials cost should not exceed £15.00
Must be made using school facilities and my own skills	The project must be made under supervision to ensure that it is my own work. Teacher and technician guidance is essential.
Must be made using easily available materials and components.	The manufacture of my product will be slowed down if the materials and components are hard to obtain.
Must be strong enough for its intended purpose.	An alarm may not get much rough treatment unless it is portable. Must be strong to protect the internal components against damage/accidents.
Must be durable.	Stand up to being in regular use. Outside use - weather proof.
Must be finished to a high quality	Non toxic finish, no rough edges, must be high quality. High quality products demand a higher price. Must work effectively. Must be reliable.
Must be portable/fixed	Easily attached or setup. Secure once in place. Resistant to interference.
Must be secure	Could be locked to prevent

	interference.
Must be comfortable or easy to use (ERGONOMICS)	Easy to operate, set up and activate (turn on).
Must be the right size for the client (e.g. ANTHROPOMETRIC data is used whenever people interact with machine or products to make sure that the sizes are suitable, this data is also very important for clothing and of course **ERGONOMICS** makes great use of anthropometric data)	Handles/buttons must be the right size to hold and operate. Hand and fingers must not get trapped.

There are more points here than you need. Some could be merged. Other products can easily use similar points and reasons.

Ideas

You should do FOUR ideas - that's two per sheet.

Label each idea with FIVE labels.

Try to ask FIVE questions about each label . Then list some possible answers. Do not answer the questions yet.

Example of a label and questions:-

Case -

1. **What material could be used? - MDF, Plywood, Acrylic sheet, mild steel, aluminium, brass, nylon.**
2. **What finish could it be? - Painted, dip coated, make use of natural properties - aluminium is corrosion resistant and can be polished.**
3. **What size/shape should it be? - Rectangular, irregular, rounded.**
4. **How should it open? - Hinged at the side, top/bottom, removable, lift off.**
5. **How will it be made? Injection moulded, laser cut, fabricated from parts, CNC milled, Rapid Prototyped, cast from aluminium by sand casting.**

Additional questions that you may be able to use for a range of

labels and projects

Can CNC be used?

Which joints/fixings are suitable for this corner?

How can this be made stronger?

How can this be made more comfortable to use (ERGONOMIC) ?

How can this part be made safer?

Can a JIG be used to make this part?

Can this part/component be bought in?

What fixings can be used to join this part on?

Evaluation of Ideas

This page is fairly self explanatory.

- Copy the specification into the table under specification points.

- Put a tick against each idea in the boxes if you think the idea met the point well; if not put a cross. e.g. an idea might be too hard to make, too expensive, too many sharp edges or small parts. not enough storage space, not a modern style, not attractive enough etc. You may of course just like the way it looks - **that is AESTHETICALLY pleasing!**

- Write any explanation in the comments section.

At the bottom of the page write a short account of why you have chosen the idea or bits of the **ideas combined into a final idea. - Use reasons based on the specification explanations e.g. This idea will fit in well with the clients needs, it is of a modern design making effective use of materials and components. the finish is safe and practical, the design will be durable in use. The controls are easy to understand and operate.**

Continue being positive based on specification reasons.

Development -Main Construction

On this page draw your chosen design neatly. Do not show all the details - this will be done on the next sheet.

Label the main parts and state the answers to some of the questions you asked on the ideas drawing. For example - the case will be made from acrylic which will be laser cut and then assembled using Tensol cement.

Development Details

On this page do several smaller drawings showing parts of your design. For example you may show details of the case construction or how the mechanism/circuit is to be put together. Where handles,switches, levers,buttons,sensors etc are to be attached.

Label and give some detail on construction e.g. the sensor will be attached by drilling a hole and gluing in using Araldite/ or drilled and tapped and then held in with a screw.

CNC work(Handles, spacers, spindles mechanisms etc.) can be attached to this sheet(or add in a plain A3 sheet with the CNC sheets glued on with Pritt stick).

Development Annotation

On this page do the final drawing label everything and for each label answer as many questions as possible.

Look back at the questions you asked on the ideas drawings - this is what you are now answering.

Use the notes section for anything you can't fit onto the drawing and also a FINAL SPECIFICATION

Orthographic Drawing

Trim the FINAL Prodesktop Orthographic drawing and paste onto this page. Also attach the component list to this sheet. Add in any other Orthographic (2D) drawings such as laser designs from 2D-Design

Final Drawing - ProdesktopDrawing

Trim and paste an album drawing of your final design

Planning Quality

List the main stages of making your product.

For each stage write about how you would check that the quality was maintained.

The most important checks are -

- **Correct size - checked with a steel rule**
- **Squareness - checked with a TRY SQUARE or by measurement of diagonals**
- **Fit - visual check looking for gaps etc. mechanisms operate, switches slide etc.**
- **Surface finish - visual and tactile (touch).**
- **Mechanical/electrical parts are secure, screws are tight etc.**

You must also describe the ways that quality would be ensured in a factory producing large batches of your product.

This is done by inspecting the work in a range of ways. Test jigs are used to check squareness and fit. Materials are also checked for quality, Finish quality is particularly important i.e. no dents or scratches. Products are also tested to make sure they work. Some products and components are tested to destruction to ensure proerties such as strength or resistance to scratching or denting. Long term testing will also take place to ensure durability.

Computers and robots are regularly used as part of the testing for quality process.

Planning

This is a kind of flowchart. Each stage is illustrated and described.:-

- In the larger top box draw a simple sketch of the process.

- In the lower box explain what is happenning, include the tools and machines or special techniques used.

- Add a time for each stage somewhere in each box (times should be 30 minutes, 1 hour and upwards)

For example:-

First Stage (This is the first Quality Check Stage as well)

- The top box could show a **sketch of a steel rule being used to check measurements.**
- The lower box would describe this - **Checking measurements of materials using a steel rule.**
- **Time 30 minutes**

Second stage

- The top box could could show a **sketch of the acrylic sheet being marked out.**
- The lower box would describe this **- marker and ruler being used, or setting up the laser cut to cut out parts.**
- **Time 1 hour**

Continue filling in as many stages as possible. Add in quality check stages where possible!

Testing

Photograph

- Use the digital camera.
- Take a picture of your final product in use.
- Stick it in the space.

How testing was carried out

Write a brief explanation of how the product was tested. This means try it out for what you said it was for. For example:-

- **Does it protect the area or property?**
- **Is it strong/durable enough?**
- **Does it operate reliably?**
- **Is it easy to operate?**
- **Is it easy to set up?**

Results of Testing

For each testing point say what happened. If all the answers are yes, add a few points of criticism! For example:-

Yes it is easy to set up but the fixing points were hard to reach.

Summary - What did the testing tell me

You can be positive here but any improvements can be included and then repeated in the Evaluation

Evaluation

Evaluation 1

Copy the specification into the table

For each specification point write a sentence saying how well your product has done. Be critical good points / bad points.

Evaluation 2

Problems with making and how they were overcome.

This is where you list any problems such as gaps in the joints, parts out of square, components breaking or failing, dry joints, parts going missing etc. Then describe how you corrected or minimised the problems.

Possible Improvements

What would you change if you made it again. Such as change materials, sizes etc.

How My Product Would Be Batch or Mass Produced

This is a very important section do not miss it out!

Here are some examples of processes used im manufacturing which can be included in your account

- **Use CNC machines to batch produce components such as handles or feet.**
- **Use more machines such as the band saw or laser for cutting rather than hand tools**
- **Use jigs to line up the work for drilling or cutting accurately without having to mark out first.**
- **Use templates where marking out has to be done.**
- **Set up a small production line.**
- **Spray paint using robots rather than hand paint.**
- **Use measuring jigs to check sizes for quality.**
- **Computers used to control and check progress and quality.**