

Lighting the Way ...

Security systems come in many forms - lights, alarms and television cameras are three examples. They have a range of purposes. For example, smoke alarms warn you of the danger of fire, closed circuit television (CCTV) can be used to identify people, and security lights can prevent crime by removing the cover of darkness. Security systems can be triggered in many different ways: a smoke alarm is triggered when there's smoke; and many security lights have motion detectors.

What you have to do

The police in your area are becoming concerned about an alleyway in the town centre; three people have been mugged there in the last month.

To help stop this crime spree they want to set up a security light system in the alleyway. They've already got some security lights, but they want you to design the electrical circuitry that will trigger the light. They also want you to design vandal-proof casing for the light and circuitry, and wall brackets to attach the whole lot to a wall.

The light should be powered using mains electricity.

The Crime Prevention Officer from your local police station has issued the following **design brief** giving details of what your design should include.

*Crime Prevention Officer
Oxbridge Constabulary*

Dear Sir/Madam,

Re: Design Brief

System details

The security light should only come on when:

- (a) it's dark and
- (b) somebody enters the alleyway.

It should turn off automatically when there's no longer anyone around.

The front of the security light casing should have a surface area of no more than 225 cm². It should be no more than 15 cm deep. It can be round, square or rectangular.

Location details

The alleyway is six metres long and two metres wide. There are two doors on each side of the alleyway, which are used by local businesses. Other than these doors, there is only one entrance to the alleyway. At the other end is a tall, brick wall.

Preferably the lamp will be attached to the brick wall, out of reach, but still low enough to light the whole area.

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Surveillance

Design brief cont ...

System protection details

The lamp and circuitry should be cased in vandal-proof casing. Some people may still attempt to smash it, even if it's high up, so the casing should have very high impact strength. It should also be able to withstand corrosion, and should withstand the effects of rain and wind. The brackets fixing the system to the wall should be strong so it can't be ripped from the wall, or blown off in a strong wind.

Costs

Costs need to be kept down, as the police force doesn't have massive spending power. At this stage your design will only be used to make one security light system. However, if it's successful, and it's reasonably priced, there may be a market for more. The police force might buy more, as may local councils, security-conscious home owners and shopkeepers.

How to set about it ...

What exactly do they want?

1. Draw a table like the one below (you may need more rows). Use the first column to list the **key design features** from the **design brief**. In the second column, "Initial thoughts", make a few notes about what you'll have to bear in mind as you begin to come up with possible solutions

| Key design feature | Initial thoughts |
|--------------------|------------------|
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| | |

2. You can now write your **design specification**. This should explain exactly what's required, and the implications of each design feature.

Generating ideas and shortlisting

3. Using the internet, library and/or resource centre, carry out some research into security light systems (you may also want to look at CCTV cameras because these often have casing with very high impact strength). Here are a few places you might like to try:

<http://www.cctv-information.co.uk/>

<http://www.ssaib.org/home.asp> (this is the website for the security systems and alarms inspection board. Use its 'find an installer' page to search for security installers in your area.)

4. Produce a number of **design ideas** using simple freehand sketches to try to visualise them. Remember your designs have to include the casing, the wall bracket and the electrical circuitry.

5. Shortlist three of your ideas, explaining the decisions behind your choices. Even at this stage you should be pretty sure your design ideas will work. Scientific principles will help, for example, you will need to know about different components of an electrical circuit such as light dependent resistors

And then there was one ...

6. You must now work out the pros and cons of your three design ideas. There are a number of ways to help you work these out. A few of them are:
 - You could carry out simple tests on models of particular components. For example, you may set up a circuit using a lamp as your security light to test it works. In some cases you may want to test a scale model of the whole structure.
 - Think about costs. Which of your security systems would be most expensive to manufacture?
 - What's the rough life expectancy of your different designs? Is one much more hard-wearing than another?
 - Could your designs or part of them be adapted for other uses? for example emergency lighting.
7. Having weighed up the pros and cons, you've probably got a decent idea which design you think is the best. But the client is the paymaster. So, to help choose a final design solution, you should get feedback (comments and suggestions) from an expert who understands your client's needs.
 - Make 2-D and 3-D drawings and/or scale models of your three design ideas. These should be of good enough quality to allow you (and anybody else for that matter) to visualise exactly what your security light system will look like.
 - Present your designs to the expert, and write down their comments and suggestions. (but if you're adamant one design is better than another, make sure you can explain why - you have to give the client what they want, but YOU are the designer!).
 - Consider the expert feedback and decide what modifications you need to make, if any, to make sure your designs meet the client's needs.
8. Choose your final **design solution** and summarise the reasons behind the choice, including how your **design solution** fulfils the **key design features** in your **design specification**, and how you have used expert feedback.

Presenting your solution

9. Decide on a suitable engineering drawing technique to present your final solution. Make 2-D and 3-D engineering design drawings, or use computer aided design (CAD) to produce them. Make sure you stick to engineering standards and conventions.

You've done the design job ...

10. You've successfully produced a **design solution** from a **design brief**. But what now? You've done the job of the designer, so you need to put your engineer's hat on. The design solution has to be turned into a **product specification** - giving the manufacturer the information needed to actually make the product.

A product specification details all the materials needed to make a product; it includes its dimensions, tolerances and details of how the different components will be joined together.

You need to decide which materials will be best to make your security light system. To decide which materials are best you should look back at the design brief and your initial research. You should also use databases and other resources to find out properties of materials.

You might also want to try tests for materials, joints and finishes to show how these can vary and influence your choice for the product specification.

COMPARATIVE TESTS