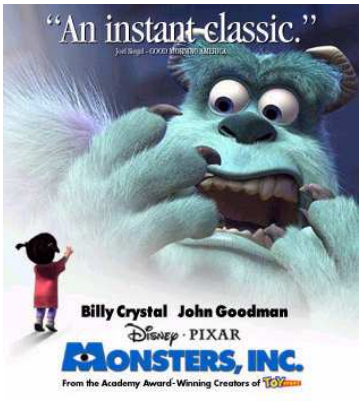
Project Planner

Design Brief

The manager of a local 'super store' has asked you to design a promotional display for the entrance to the store that can be used to promote a product of your choice. The display needs to be interactive, so it will operate when someone enters the store or stands in front of the display. You have been asked to design and make a working model of this, to show how it will work.



http://disney.go.com/DisneyPictures/monstersinc/index2.html

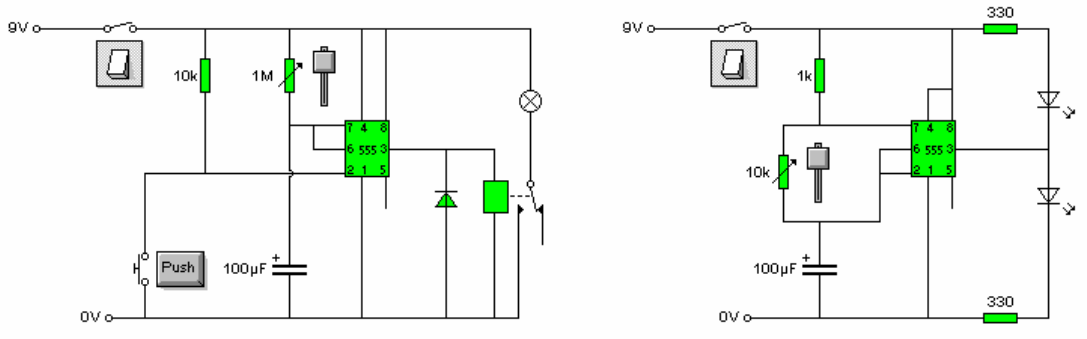
	Week Number																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Introduction																				
Theory																				
Research																				
Design																				
Time Plan																				
Manufacture																				
Evaluation																				

Notes:

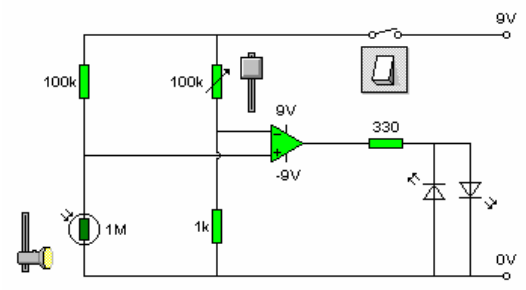
1. The final coursework deadline is: **Easter**
2. This planner does not include half terms or holidays.

Integrated Circuits

A **555-timer** chip can provide an **astable** (one state) or a **monostable** (constantly changing) output. When the voltage between the trigger pin 2 and ground pin 1 falls (press switch) pin 3 voltage rises and discharge pin 7 is disconnected. The capacitor charges until threshold pin 6 and ground reach 2/3 supply, pin 3 voltage falls and pin 7 reconnects. As a monostable the timer returns to output 0V after a time set by the resistor/capacitor. As an astable, pin 2 connects to pin 6 producing an automatic restart. These **clock pulses** can drive a flashing LED, a loudspeaker, a transistor, an IC, etc.

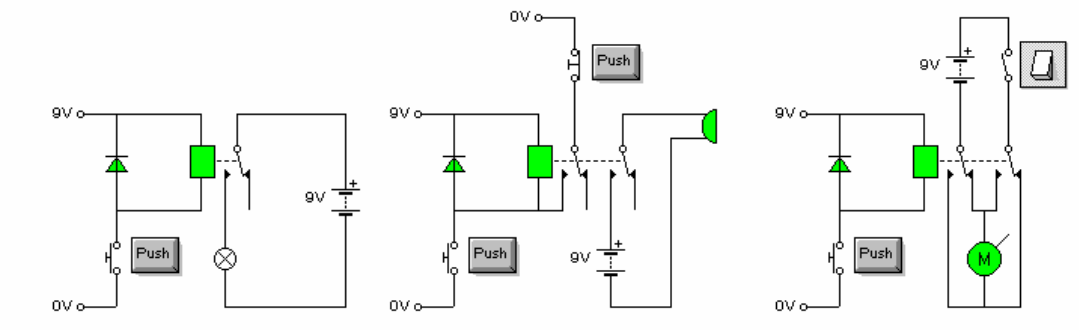


A 741 **operational amplifier** or op-amp is used as a comparator or amplifier with one output and two inputs. A voltage at the '+' input causes a positive output (source) if it is more than the '-' input and a negative output (sink) if it is less than. The **voltage gain** is 100 000 and the output current is 10 mA. As gain is very high resistors are used to produce **negative feedback** and give a lower but predictable and constant voltage gain.



Motors and Relays

1. A **relay** uses induction to isolate circuits. Other inductors include **motors and solenoids**. A **protective diode** is used to prevent back emf.
2. A **two-pole relay** is used for motor reverse control and latched (memorised) switching.



Formula

1. For **resistors in series** the effect is increased:

$$R\ total = R1 + R2 + \ldots \qquad \text{e.g. } R\ total = 100 + 100 = 200\,\Omega$$

2. For **resistors in parallel** the effect is decreased:

$$\frac{1}{R\ total} = \frac{1}{R1} + \frac{1}{R2} = R\ total = \frac{R1 \times R2}{R1 + R2}$$

$$\text{e.g. } R\ total = \frac{100 \times 100}{100 + 100} = \frac{10\,000}{200} = \frac{100}{2} = 50\Omega$$

3. **Ohm's law** states that if conditions of a conductor do not change then **voltage and current are proportional.** E.g. an LED requires 20mA from a 9V battery, the voltage drop across the LED is 2V and as V / I = R, the resistor value will be 7V / 0.02A = 350Ω or 330Ω preferred value.

A **transistor** is a semiconductor used as a high-speed switch or amplifier with three connections: base, collector and emitter. A '**Darlington Pair**' enables a larger current gain.

To calculate **dc current gain (h_{fe})**: $h_{fe} = I_c / I_b$

http://fp.keystage4dt.f9.co.uk/eletronic_products.htm

http://www.howstuffworks.com/category.htm?cat=Elec

Mechanisms

1. A **mechanism** changes a given input motion or force into a desired output motion or force. There are four types of motion: linear, rotary, reciprocating and oscillating.
2. A **Mechanical Advantage (MA)** is gained when the **effort** applied is further from the **fulcrum** than the load. MA = Load / Effort
3. **Moments** are the product of force (N) x distance (m) and are measured in Newton meter's (Nm).
4. The **Gear or Velocity Ratio (VR)** is the relationship between the input speed (driver) and the output speed (driven) and can be calculated using the number of gear teeth or the diameter of the pulleys. The VR for **compound gears and pulleys** is worked out by multiplying the velocity ratio of each pair.
5. **Levers and linkages** transmit motion and amplify or apply forces.
6. **Spur gears** transmit rotary motion, together they form a **gear train**, an **idler gear** enables motion in the same direction. **Bevel gears** transmit motion through 90º. **Worm and wheel gears** produce a large speed reduction through 90º. **Crown wheels** produce a large speed increase through 90º.
7. **Flat belts and pulleys** transmit rotary motion, toothed and vee belts provide a more positive drive. **Cone pulleys** produce adjustable speeds. **Chain and sprocket** drives transmit a more positive rotary motion. A **jockey wheel** maintains tension in drive belts and twisting drive belts changes the direction of rotation.
8. A **Crank and slider, a cam and follower and a rack and pinion** transmit/convert motion. Terms used for a cam are **rise, fall, stroke and dwell**. **A Crank** has a mechanical advantage away from the centre of rotation. **Crankshafts** convert multiple linear motions to a single rotary motion. **Camshafts** convert a single rotary motion to multiple linear motions. **Ratchet and pawl** allows rotary motion in one direction only. **Eccentrics** are circular cams producing a simple harmonic motion.
9. Bearings support shafts and cope with radial (rotating) and axial (along shaft) loads and can be **plain or bush, split, ball or roller bearings**. To reduce friction moving parts are lubricated using **oil or grease**.

http://www.howstuffworks.com/category.htm?cat=Eng

Product Analysis

Promotional Displays

Use a range of sources, photographs/pictures and some text to show:

- three different types of promotional displays (e.g. a film, a CD and sportswear)
- how each promotional display works (i.e. show input, process and output)
- how each promotional display was made (i.e. materials, components and processes used)
- where the information came from (e.g. a book, the Internet, a magazine)

Tip: The following web site will help get you started:

http://www.performancecompanies.com/product.html

Market Research

Questionnaire

In my survey I asked the following questions:

1. Do you believe there is a need for promotional displays? □ Yes □ No

2. Which type of display do you prefer?

□ Static □ Interactive

3. Which of the following outputs do you prefer?

□ Light □ Sound □ Movement

4. Do you prefer to buy traditional or contemporary designs?

□ Traditional □ Contemporary

5. How much would you be willing to pay for a promotional display?

Less than £5 □ £5 - £10 □ £10 - £15 □ more than £15 □

Thank you for your time

Tip: Use this questionnaire to find out what the user wants. Ask family and friends do not ask people that you do not know! To achieve a higher level you will need to include some questions of your own. The following web site will help get you started:

http://www.performancecompanies.com/product.html

Analysis

Research

From my research it is apparent that my design must:

Tip: In this section you must write about how your research relates to your design (e.g. the majority of people asked said they prefer contemporary designs. My designs will need to be contemporary. I will need to carry out some further research into this type of design.)

Design Specification

Design Specification

To be successful my design must:

1. promote the item concerned
2. attract the attention of potential customers
3. not weigh more than two kilograms
4. be easy for sales assistance to maintain
5. cost no more than five pounds per unit to mass produce
6. be easy for sales assistance to assemble
7. comply with BS EN 50088 – electronic products
8. include a simple mechanical system e.g. lever/linkage, crank and slider, pulley system
9. make use of a 741 op amp or a 555 timer

Tip: To achieve a higher level you will need to add a few more items to your specification (e.g. reliability, safety or appearance). Remember what you write down must be measurable.

Ideas

Idea 1

Use labelled sketches, comments and photographs/pictures to show:

- three different ideas for your promotional display design
- discussions that you have had about your promotional display design
- models that you have made to test your ideas for your promotional display design
- materials, components and processes that you might use to make your promotional display

Tip: Sketch or model your ideas in 2D and 3D and then discuss them with the user. Draw your three best ideas on an **A3 page**. Add notes and a border use pencil crayons and if possible a fine liner pen.

Development

Final Idea

Use labelled sketches, comments and photographs/pictures to show:

- the reasons for choosing your final promotional display (refer to your specification)
- discussions that you have had about making your final promotional display
- models that you have made to help you decide how to make your final promotional display
- materials, components and processes that you will use to make your promotional display

Tip: Sketch or model your development in 2D and 3D and then discuss your decisions with the user. Draw your development on an **A3 page**. Add notes and a border use pencil crayons and if possible a fine liner pen.

Final Design

Use orthographic and isometric drawings to show:

- final dimensions/sizes, materials and components
- assembly details
- cutting lists for materials
- order list for components with order numbers and prices

Tip: Use graph paper, drawing boards or ICT to produce an orthographic view of your final design include a front and side elevation, a plan and final dimensions. If possible produce a fully rendered view of the final idea. Draw your final idea on an **A3 or A4 page**.

Plan

How to make my promotional display

1. **Circuit Assembly.** Collect PCB and components. Use PCB drill to drill holes for component legs and drill 1mm holes for leads, wear safety goggles. In a well-ventilated area, tin circuit pads leaving holes open and tin components as required. Use the circuit diagram and locate components, heat the component leg/pad producing a 'volcano' shaped joint. Solder resistors, flying leads and battery snaps first, then polarised components. Check for dry-joints, broken tracks and loose or damaged components.
2. **Measuring and marking out.** Collect materials. Measure and mark out MDF using spray mounted picture, bradawl and compass to mark centres and circles. Use steel rule, pencil and try square, marking gauge and marking knife, to mark out squares and rectangles. Clear and tidy workshop.
3. **Cutting and shaping.** Cut MDF using Hegner saw set at a 5°-draw/draft angle. Wear safety goggles. Hold MDF in woodworkers vice and cut using coping saw, cross-file, draw file and finish with glass paper. Use glass paper to round edges. Clamp work and use pillar drill to drill holes. Wear safety goggles. Clear and tidy workshop.
4. **Joining.** Attach 3mm MDF using PVA glue and panel pins and use a damp cloth to remove excess adhesive. Clear and tidy workshop.
5. **Forming.** Place pattern on platen and lower, remove protective cover from polystyrene and clamp in position, pull heater into position and turn on, when polystyrene is soft, remove heater, raise and lock platen and evacuate air. Switch former off and remove polystyrene when cold. Clear and tidy workshop.
6. **Cutting and shaping.** Ask teacher to cut mould, leave pattern in mould, clamp and use pillar drill to drill holes. Wear safety goggles. Clear and tidy worksh op.
7. **Joining.** Attach PCB and components. Print graphic image on self-adhesive paper or use spray adhesive in a well-ventilated area and attach to mould. Clear and tidy workshop.

Tip: Use this guide with advice from your teacher to help you write a plan for your own project, this can be a simple flowchart or a sequence diagram (comic strip). Include quality control, health and safety points and say how long you think each stage will take.

Evaluation

The Final Product

Use photographs/pictures, text and comments to show:

- your final promotional display
- how well the promotional display worked (refer to the specification)
- how you could improve the promotional display (e.g. more features, colour or greater movement)

Also write about improvements that you could make to:

- your approach to the research
- your approach to the design work
- your approach to the planning
- your work in class
- your homework

Tip: Keep the evaluation simple. Do not give excuses but state facts. Explain any problems that you may have had and how you overcame them. Say what the users think about your work.