Workbook AS 2.2 AS91891 v1

Apply conventions to develop a design for a digital technologies outcome

Stage 1 - Purpose and end-users

Students need to describe the purpose and end-users of their outcome

1 **Purpose & end-users** | 2 Design tools & conventions | 3 Relevant Implications | 4 Generating & modelling | 5 Select & Justify

Who are the end-users

All real-world digital technology outcomes have an end-user in mind.

1. Users that will administer the outcome. Fix it if it breaks, maintain it, update it, replace the batteries
2. Users that will use it. Read and interpret the data or information and use this information to make decisions.

What it will do?

When exploring the purpose of your project, it's good to list out what your outcome will do. Do this by identifying input, process and output and power requirements.

3. What **inputs** will your outcome have?
   Inputs allow you to sense or monitoring environmental conditions such as light levels, temperature, soil moisture and water reservoir levels. Sensing also refers to monitoring switches for change of state.
4. What **outputs** will your outcome have?
   Outputs refer to the use of valves, fans, motors, servos, LED's, Radio transmitters etc and also the controls on a user interface that provides the user with information or alerts on the state of the electronic system.
5. What **processes** will your outcome do?
   The decisions that need to be made or data that needs to be stored.
6. Components have specific **power** requirements, what will your outcome require?

What will look like?

When exploring the physical look and feel of your project, it's good to list ...

7. What size, shape, colour is your outcome? What box or enclosure will your outcome have to house all components? What mechanical or moving parts are required?
8. Whether your outcome will be breadboard, Soldered board or Printed Circuit board? How you will make your outcome robust?
9. How users will interact with it?
   How will users operate, control or just interact with your outcome? How will users know your outcome is working? What display devices (LED, LCD, Module Phone, Webpage) will your outcome use to display data on?

Read the section Purpose and End users. For each of points 1-9 list your ideas.

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8. _____
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9. _____
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Describe the purpose of the outcome and the requirements of the end users.

Stage 2 - Design tools and conventions

Students need to investigate design tools and conventions

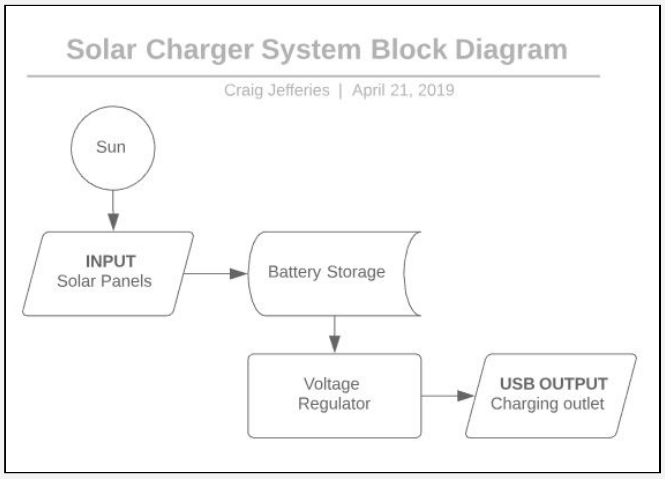
1 Purpose & end-users | **2 Design tools & conventions** | 3 Relevant Implications | 4 Generating & modelling | 5 Select & Justify

Block Diagrams

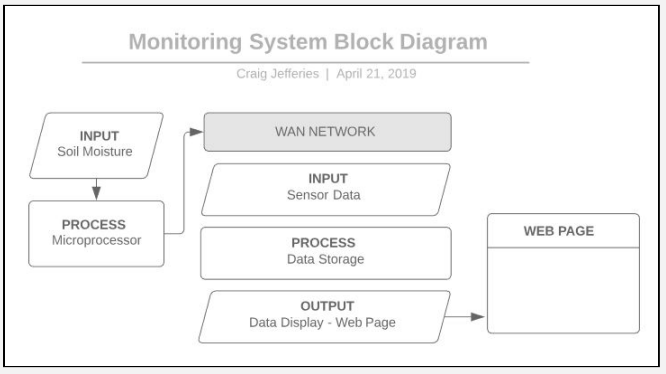
System Block Diagrams

Block diagrams are used to help decompose a system into components. They are a method of explaining complex systems in a simple manner. They are made up from labelled blocks which are joined by arrows. The arrows indicate the direction of flow. No attempt is made to show the components used within a block, only the inputs and outputs are shown. This way of looking at circuits is called the systems approach.

System Block diagram for Solar Charger System. created with lucidchart.com



System Block Diagram for Monitoring System created with lucidchart.com



Conventions for System Block Diagrams

Conventions are ways in which things are usually done or agreed on ways of doing things

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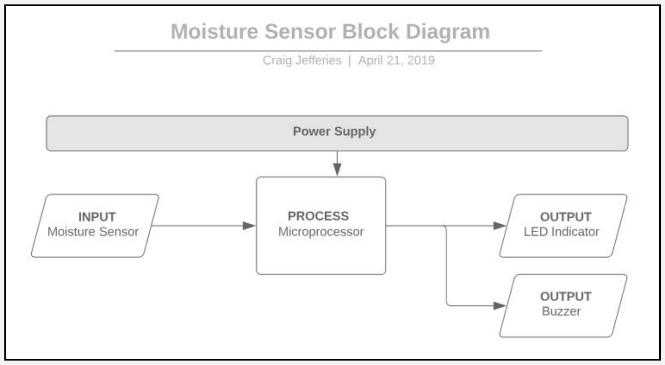
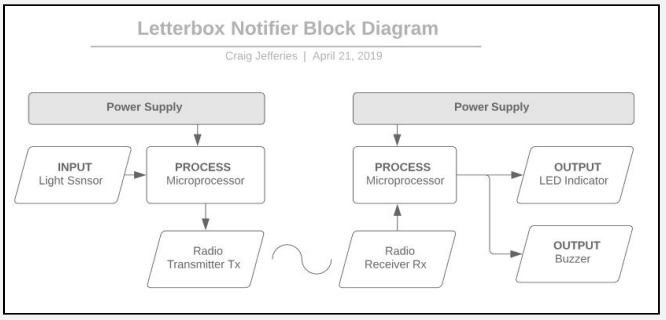
Electronic Block Diagrams

In electronics, block diagrams are a visual way or of thinking about the inputs (sensors, buttons), processes (logic and control structures), and outputs (LED, Buzzer, Motors, Servo's).

Block Diagram for Moisture Sensor created with lucidchart.com



Block Diagram for Letterbox Notifier created with lucidchart.com



Inputs: Circuits convert physical world inputs (like Touch, Light, Temperature, Moisture Level, Water Level, Movement) to electrical voltage signals which are processed by a microcontroller. These physical world inputs are sensed using electronic components.

- The thermistor will sense temperature,
- Light Dependent Resistor (LDR) will sense light levels,
- Conductivity Probes sense moisture,
- Tilt or push switch will sense movement

Processes: The electrical signals sent to a microcontroller to be processed. A Microprocessor reads input, makes decisions and then turns output pins on or off. We have a number of different microprocessors available this year to use

- PICAXE 08m2 and 14m2: An 8-14 Pin microprocessor
- Atmel ATtiny85: An 8 Pin microprocessor
- Arduino Nano: 12 Digital pins and 7 analogue pins on a development board

Outputs: Outputs include devices such as Lights LEDs, Motors, switches, speakers or buzzers to make sounds. Even sending data via Infrared or Radio Transmission (these are outputs)

Conventions for Electronic Block Diagrams

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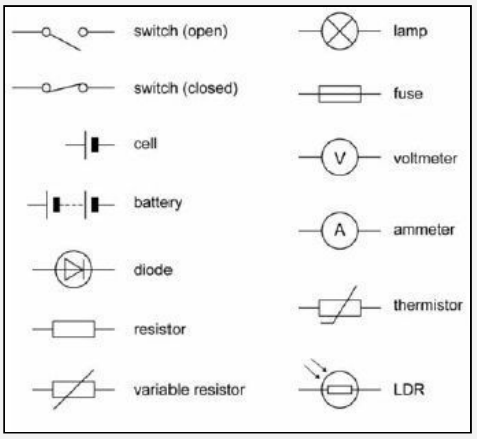
Circuit Schematics



Circuit Schematics are a visual design of the hardware components that make up an electronic system. Schematics get us thinking about the individual components we need and the component specifications (size, shape).

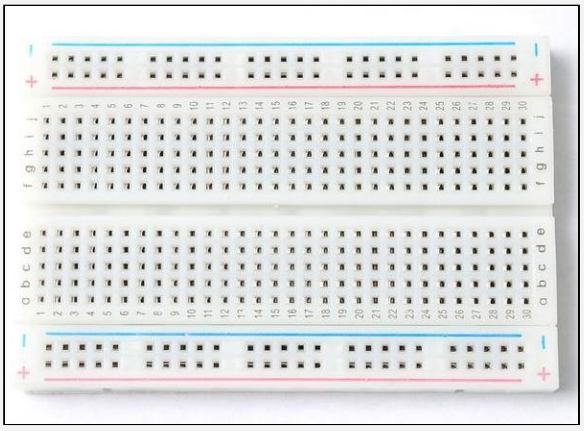
Some rules when sketching circuit schematics

- Make sure you get the circuit symbols sorted.
- Use a Ruler, making sure all the wires are connected

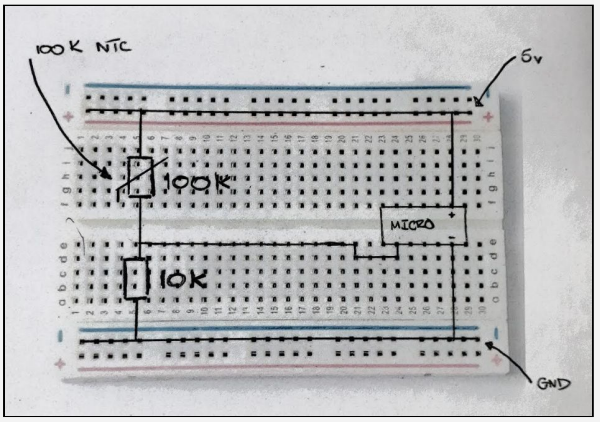
Breadboard friendly circuit schematics

It is much easier to sketch your circuit schematic using a breadboard layout. As this makes shifting from design to develop quicker.

A typical Breadboard



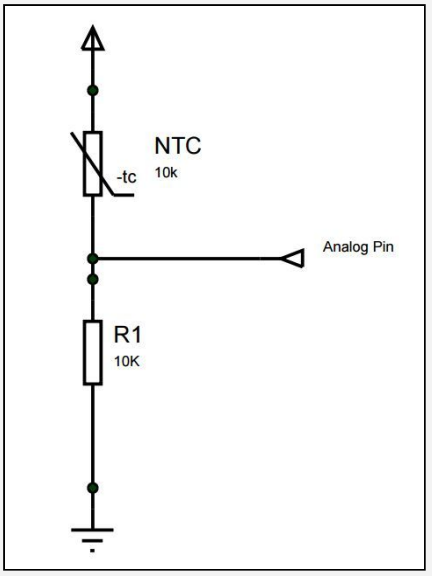
Circuit Schematic for Temp Sensor Input interface



The diagram opposite shows another way of drawing a circuit schematic for a Temperature sensor input.

- It uses symbols for Positive (Vcc) and Ground (GND)
- It uses a symbol for the Analogue Pin of the Microprocessor

Circuit Schematic for Temp Sensor Input interface



Conventions for Electronic circuit schematics

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Enclosure Mockups

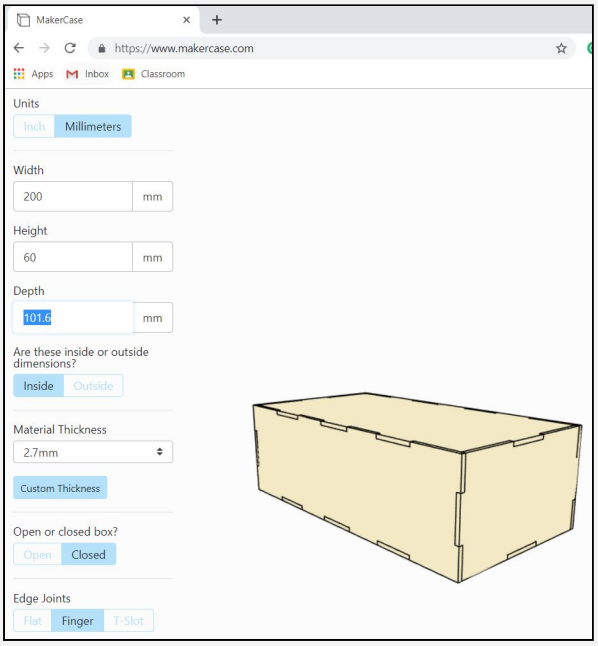
Electronic enclosures are the container or structures that hold all our components and hardware and wires in one place.

Premade plastic enclosures

It is possible to purchase plastic enclosures with screw-on lids for around NZ$10-$20 from a range of suppliers.

Custom Laser Cut cardboard enclosures

For the purposes of quickly modelling ideas, it is possible to laser cut < 3mm cardboard or < 3mm MDF to construct a box-like enclosure.
Websites like makercase.com enable you to quickly make boxes with a range of joints we can glue together with PVA.



When exported to SVG can be imported into a Vector graphics program like Adobe Illustrator for creation of holes for buttons, LEDs etc

makercase.com

Conventions for enclosure mockups

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Interface Wireframes

The Electronic User Interface

Electronic user interfaces provide the user with a way to understand the state of the system, and also to provide a means to control or adjust aspects of the system.

Mockups of the electronic user interface to focus on

- The size and position of buttons, switches,
- The position and colour or LED's for displaying status on the system

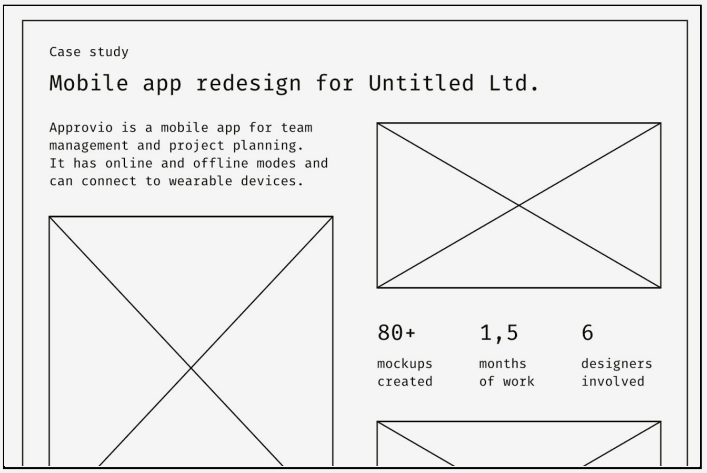
Conventions for user interface mockups

Website wireframes

Outcomes such as mobile apps and websites have specific interfaces that the user interacts with. From small mobile phones to large screen monitors to tablets.

User interface mockups are used to help determine the content inside the screen.

- Headings
- Paragraph Text
- Images, pictures or Graphs / Charts
- Buttons and navigation



Conventions for wireframes

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For each of the design tools listed below, describe them and list the conventions

1. **System Block Diagrama**

   Description

   _____

   _____

   Conventions used

   _____

   _____

2. **Circuit Schematics**

   Description

   _____

   _____

   Conventions used

   _____

   _____

3. **Enclosure mockups**

   Description

   _____

   _____

   Conventions used

   _____

   _____

4. **Interface Wireframes**

   Description

   _____

   _____

   Conventions used

   _____

   _____

Stage 3 - Relevant Implications

Students need to explain relevant implications

1	2	3	4	5
Purpose & end-users	Design tools & conventions	**Relevant Implications**	Generating & modelling	Select & Justify

Explaining relevant implications that need to be addressed in the Design

Social	Health and safety	Legal	Ethical
Will it have a positive social impact	How can we maintain safety within the development and ongoing operation?	Does it obey or comply with all relevant laws? Does it comply with Copyright laws?	Is it right? Should we be doing this? Should we be using this hardware or software?

Intellectual property	Privacy	Accessibility	Usability
Who owns the ideas, the images, the code?	Is data kept private?	Can anyone access it? Can it be accessed on any device?	Is it easy to understand? Is it easy to navigate or control? Is it easy to use?

Functionality	Aesthetics	Maintainability	End-user considerations
Does it work as intended?	Does it look good? What does looking good mean in the context of your outcome?	How will it be maintained? Can you keep it up to date? How will you make it easy to fix?	What specific needs does the end-user have?

Software Standards	Reliability	Robustness	End-user considerations
What are software codes of practice and how can your outcome adhere to these?	What would happen if the system was unreliable? How could we improve reliability?	Will your system be used outside? Does it need to be waterproof?	How will the user know its working? Are end-users elderly, young or have special needs?

Rank the implications

There are at least 16 implications that may or may not relate to your outcomes design and development. Rank the implications from most (1) to least (16) important

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____

Explain how you will address implications

Explain how the most relevant implications affect your project, or how you intend to address these within the design

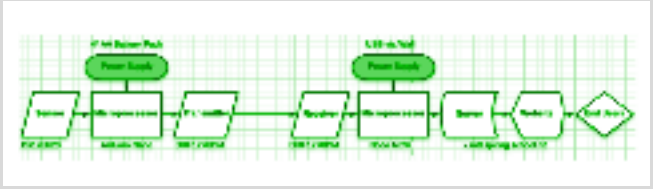
Stage 4 - Generating and modelling

Student need to use design tools and conventions to generate a range of design ideas

Generate ideas

Generating a range of design ideas for

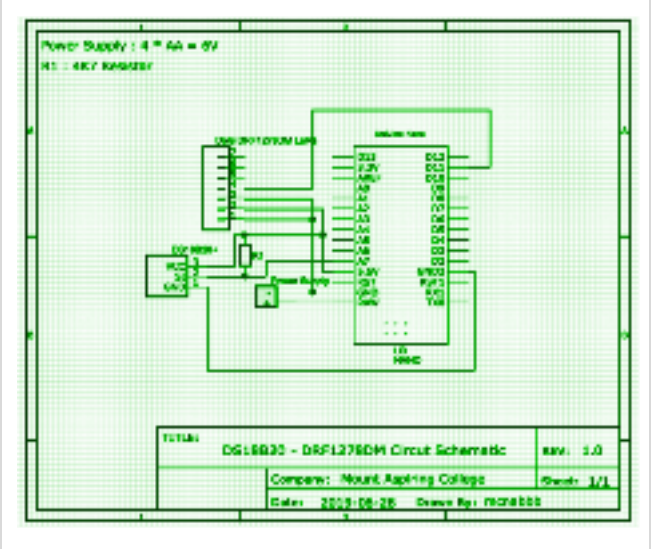
System Block Diagram
Sketch a system block diagram for your outcome. Apply design conventions



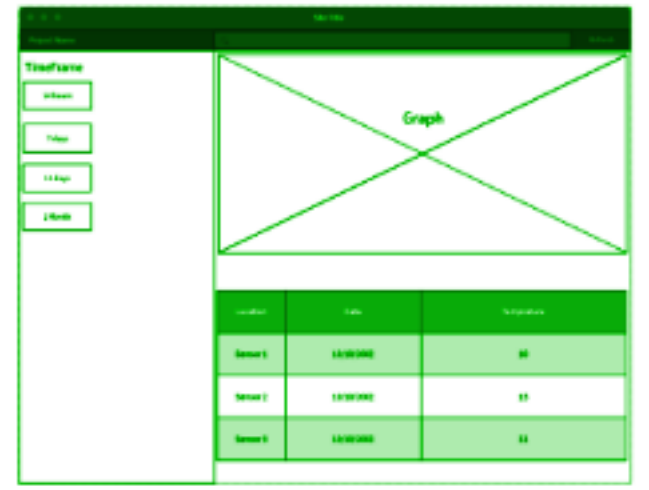
Database table and fields
Sketch your database table and field ideas for your outcome. Apply design conventions

```
{
    "id": "36",
    "location": "Ky",
    "quantity": "c",
    "data": "2.25",
    "created_at": "2019-06-24 12:00:55"
},
{
```

Electronic Circuit Schematic
Generate a circuit schematic for your outcome. Apply design conventions



Webpage wireframes
Sketch website wireframes for your outcome. Apply design conventions



Model your ideas

Model a range of design ideas. Modelling means to test, to check or to trial in order to gain information on your design. Let's look at a few modelling examples

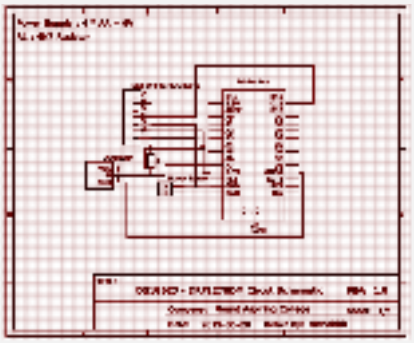
Modelling the System Block diagram

Modelling that could be done:

1. Ask your teacher whether you have got all the inputs, outputs and processes right!
2. Check that you have used correct design conventions (shapes and symbols)

Does the design address relevant implications?

Modelling the Circuit Schematic

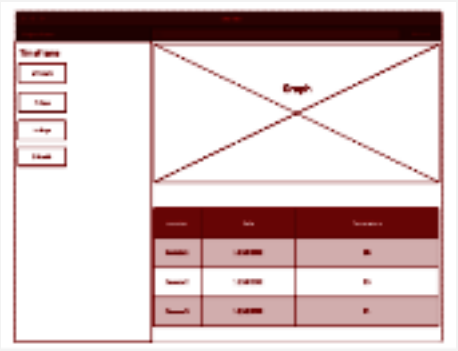


Modelling that could be done

1. Ask your teacher whether you have the circuit diagram drawn correctly? Have you used correct design conventions?
2. Construct a breadboard version of the circuit and program it, then test to make sure it works as expected

Does the design address relevant implications?

Modelling the website wireframe



Modelling that could be done

1. Survey users, asking them
    a. Do you understand what the page is about?
    b. Can you read and interpret the data that is being displayed?
    c. Does the layout work on multiple devices (laptop, phone etc)
    d. Does the typography, colours fit with the theme of the site

Does the design address relevant implications?

Generate and model a range of design ideas.

Stage 5 - Select and Justify

Students need to select and justify a design idea

1 Purpose & end-users | 2 Design tools & conventions | 3 Relevant Implications | 4 Generating & modelling | **5 Select & Justify**

Selecting a design for the purpose of the outcome and explain the appropriateness of the design

- explaining how the chosen design uses appropriate conventions and showing within your designs that you have addressed relevant implications and end-user considerations
- justifying how the chosen design addresses implications, end-user considerations, and uses appropriate conventions.

List the design conventsions used, and the relevnat implications you chose

Design Tools and Design Conventions used

Relevant Implications you chose

Justify how the chosen design addresses implications, end-user considerations, and uses appropriate conventions.