The Systems Lab · Teacher sheet

GCSE D&T · AQA 3.1.4 systems approach to designing · application lesson · 50 minutes · works solo

The idea

Each student is a systems engineer at an electronics company. Clients describe what their product must do; students design the system as an input → process → output block diagram, choosing exact components from the catalogue and justifying them.

How the projects work

Students do at least two Bronze projects first, then any order.

Print (per student)

- Component Catalogue (page 2). Can be shared or laminated.
- Project Board (pages 3–4), double-sided.
- Systems Report (pages 5–6), double-sided.

Running it

1. **5 min:** PowerPoint to the worked example (an automatic porch light; not on the Project Board).
2. **30 min:** students work alone: two Bronze first, then any order.
3. **10 min:** students mark their OWN report in green pen using the answer slides.
4. **5 min:** totals and ranks. **The Audit:** anyone claiming Senior Engineer or Head of Electronics brings their report to you.

Fees

Bronze £100 · Silver £200 · Gold £300 · Platinum £500. **Full fee** = right input + process + output, each named precisely, plus a reason with **so…** · **Half fee** = one block missing or vague · **£0** = wrong sensor · **+£50** = a sensible rejected component with a reason.

Ranks

£0–399 Technician · £400–899 Systems Engineer · £900–1,599 Senior Engineer · £1,600+ **Head of Electronics**

Encourage students to draw the three-box block diagram for every project; it is exactly what exam questions ask for.

Component Catalogue

Every electronic system = INPUT → PROCESS → OUTPUT. Choose a component for each block.

Inputs (sensors and switches)

Component	What it senses	How it behaves	Typical uses
LDR (light-dependent resistor)	Light level	Resistance goes UP as it gets darker	Night lights, street lights
Thermistor	Temperature	Resistance goes DOWN as it gets hotter (NTC)	Thermostats, fire and frost alarms
Pressure sensor / pressure pad	Weight or pressure	Switches or changes when pressed	Door mats, counters, scales
Push-to-make switch	A press	Circuit made only while pressed	Doorbells, buttons, keypads
Micro switch	Something touching a lever	Very small force makes it switch	Doors, limit stops in machines
Tilt switch	Being tilted	Ball rolls to make the circuit	Bike alarms, toppled heaters
Reed switch	A magnet nearby	Closes when a magnet is near	Door and window alarms
PIR sensor	Body heat moving	Signals when a warm body moves	Burglar alarms, security lights

Processes (the 'brain')

Component / function	What it does
Microcontroller (programmable)	Runs a program: makes decisions, counts, times and controls outputs. One chip can do several jobs.
Timer	Waits a set time, or switches something on for a set time.
Counter	Counts events (presses, people, turns).
Decision (if…then)	Checks a condition, e.g. IF dark AND movement THEN alarm. Uses AND / OR.

Outputs

Component	What it does	Typical uses
Buzzer	One loud tone	Alarms, warnings, timers
Speaker	Any sound: tunes, speech	Doorbells, toys, music
Lamp / bulb	Bright light	Warning lights, lighting
LED	Low-power light, many colours	Indicators, night lights
Motor	Rotary movement	Fans, moving parts

Project Board

Do at least two Bronze projects first. Write the client's name on your report.

Bronze

GlowNight — BRONZE £100

“A night light for a child's room that switches on by itself when it gets dark.”

DingDong — BRONZE £100

“A doorbell that plays a sound when a visitor presses a button.”

GreenThumb — BRONZE £100

“A warning light that comes on when the greenhouse gets too hot.”

FridgeAlert — BRONZE £100

“A buzzer that sounds if the fridge door is left open for 30 seconds.”

Silver

SafeShed — SILVER £200

“An alarm that sounds only if someone moves in the shed at NIGHT.”

TiltGuard — SILVER £200

“A bike alarm that sounds if the parked bike is moved.”

EggTimer Co — SILVER £200

“Press start; it beeps after exactly 3 minutes.”

MuseumCount — SILVER £200

“Count visitors stepping on a door mat; light a FULL sign when 50 are inside.”

Project Board (continued)

Gold

FrostWatch — **GOLD £300**

“A garden lamp that flashes when the temperature falls below 2 °C at night.”

LockerSafe — **GOLD £300**

“A locker alarm: sounds if the door opens without the right 4-digit code.”

StairLight — **GOLD £300**

“Press a button at the top OR bottom of the stairs: the light stays on for 60 seconds.”

FeverCheck — **GOLD £300**

“A thermometer: green LED below 38 °C; red LED and beep at 38 °C or above.”

Platinum

GrowBox — **PLATINUM £500**

“A smart greenhouse: fan on when too hot; grow lamp on when too dark in the day; count days since planting.”

SafeCross — **PLATINUM £500**

“A pedestrian crossing: press the button, wait 10 s, then lights change and a beeper sounds while it is safe to cross.”

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Systems Report

Name: _____ Mark in GREEN pen

Example: *INPUT: LDR · PROCESS: microcontroller decides if it is dark · OUTPUT: lamp · so… the light comes on by itself at dusk.*

Client	INPUT	PROCESS	OUTPUT	So…	I rejected … because …	Fee £

Systems Report (page 2)

Name: _____ Mark in GREEN pen

Example: *INPUT: LDR · PROCESS: microcontroller decides if it is dark · OUTPUT: lamp · so… the light comes on by itself at dusk.*

Client	INPUT	PROCESS	OUTPUT	So…	I rejected … because …	Fee £

TOTAL EARNED: £_____ Rank: Technician · Systems Engineer · Senior Engineer · Head of Electronics (circle)