IGCSE ICT — CHAPTER 5

THE EFFECTS OF USING IT

Microprocessor-controlled devices

Transport systems • Health and safety

INSTRUCTOR: TR. WAILINHTET

LEARNING OBJECTIVES

01 Explain microprocessor-controlled devices in the home

02 Evaluate effects on lifestyle, leisure and fitness

03 Discuss data security and social interaction

04 Explain IT monitoring and control in transport

05 Describe autonomous vehicles and their risks

06 Identify computer-related health risks and prevention

5.1 MICROPROCESSOR-CONTROLLED DEVICES

LABOUR-SAVING DEVICES

- Washing machines
- Microwave ovens and cookers
- Dishwashers
- Robotic vacuum cleaners
- Smart fridges and freezers

OTHER DEVICES

- Alarm clocks and televisions
- Central heating / air conditioning
- Home entertainment systems
- Mobile phones and tablets

EFFECTS ON EVERYDAY LIFE

POSITIVE EFFECTS

Less manual work

More leisure time

Remote control from smartphones

Improved home security

Less food waste

NEGATIVE EFFECTS

Reduced physical activity

Dependence on technology

Loss of household skills

Cybersecurity threats

Potentially more electronic waste

EFFICIENCY VS WASTE

ADVANTAGES

- Automatic switch-off can save energy
- Programmable tasks simplify operation
- Devices offer additional functions

DISADVANTAGES

- Circuit boards can be costly to repair
- Some devices are difficult to operate
- Standby mode wastes electricity

DATA SECURITY AT HOME

RISKS

Internet-connected devices can be hacked

Default passwords expose personal data

Smart devices may reveal routines

Payment information could be stolen

PREVENTION

Use strong, unique passwords

Change default passwords

Install software and security updates

SOCIAL INTERACTION

BENEFITS

Meet people with shared interests

Stay in touch using VoIP and chat

Communicate at lower cost

DRAWBACKS

Less face-to-face contact

Risk of social isolation

Online aggression and cyberbullying

5.1.2 MONITORING TRANSPORT

Traffic monitoring on motorways

Congestion-zone monitoring

Automatic number plate recognition (ANPR)

Automatic control of traffic lights

Air traffic control

Railway signalling

SMART ROAD SYSTEMS

HOW THEY WORK

Central computers monitor traffic

Electronic signs adapt to conditions

Traffic can be redirected after accidents

TRADE-OFFS

Reduced congestion and journey time

More efficient road networks

Hacking or system failure can cause disruption

TRANSPORT CONTROL SYSTEMS

ADVANTAGES

- More efficient timetables
- Reduced human error
- Automatic detection of offences
- ANPR can identify stolen vehicles

DISADVANTAGES

- System-wide failures
- Hacking and disruption
- Poor design can threaten safety
- ANPR raises privacy concerns

AUTONOMOUS VEHICLES

Driverless cars, buses and vans use cameras, sensors, microprocessors and actuators.

Sensors collect data → microprocessor processes it → actuators control braking, steering and gears.

AUTONOMOUS CAR: KEY PARTS

INPUT + PROCESSING

Cameras capture visual information

Radar and ultrasonic sensors detect surroundings

Microprocessors interpret the data

OUTPUT + ACTION

Actuators apply brakes

Actuators change gears

Actuators steer the vehicle

Continuous monitoring supports safety

EXAMPLE: RED TRAFFIC LIGHT

1 Cameras detect the traffic light

2 Control system identifies red

3 Microprocessor signals actuators to brake

4 Sensors continuously monitor the surroundings

5 When green, the vehicle moves only if safe

AUTONOMOUS VEHICLES: EVALUATION

ADVANTAGES

- Potentially fewer human errors
- More efficient journeys
- Reduced congestion
- Self-parking and less driver stress

DISADVANTAGES

- High initial cost
- Hacking and software risks
- Sensors need maintenance
- Public reluctance and possible job losses

AUTONOMOUS TRAINS

TECHNOLOGY

LiDAR creates 3D representations

Cameras and proximity sensors

GPS and on-board computers

Actuators control doors and braking

EVALUATION

Better punctuality and scheduling

Potentially lower staffing costs

High installation costs

Security and passenger safety concerns

PILOTLESS AEROPLANES

CONTROL FEATURES

Sensors monitor turbulence and cabin pressure

GPS supports navigation

Actuators control throttle, flaps and rudder

POTENTIAL CONCERNS

High cost and maintenance

Complex in-flight emergencies

Hacking and software glitches

Passenger acceptance

5.2 HEALTH RISKS FROM IT

Back and neck strain

Repetitive strain injury (RSI)

Eyestrain

Headaches

Ozone irritation associated with laser printers

POSTURE AND REPETITIVE STRAIN

BACK AND NECK STRAIN

Cause: long periods sitting at a computer

Prevention: adjustable chair, footrest, correct monitor height

RSI

Cause: repeated keyboard or mouse use

Prevention: wrist support, correct posture, breaks, ergonomic equipment

EYE PROBLEMS AND HEADACHES

EYESTRAIN

Causes: long screen use, glare, poor lighting

Prevention: regular breaks, control reflections, eye tests

HEADACHES

Causes: reflections, flicker, lighting

Prevention: reduce glare, adjust lighting, take breaks

OZONE IRRITATION

Potential source: laser printers in offices

Possible effects: dry skin and respiratory irritation

Risk reduction: suitable ventilation, separate printer rooms, or inkjet printers where appropriate.

EXAM PRACTICE • DISCUSS

Q1 Give three advantages and three disadvantages of microprocessor-controlled devices at home. [6]

Q2 Explain two security risks associated with smart home devices and how to reduce them. [4]

Q3 Describe three benefits of smart road systems. [3]

QUICK RECAP

What is the role of an actuator?

How can ANPR affect privacy?

Name two risks of autonomous transport.

What causes RSI?

Give two ways to prevent eyestrain.

THANK YOU

CHAPTER 5 — THE EFFECTS OF USING IT

TR. WAILINHTET

WWW.WAILINHTET.COM

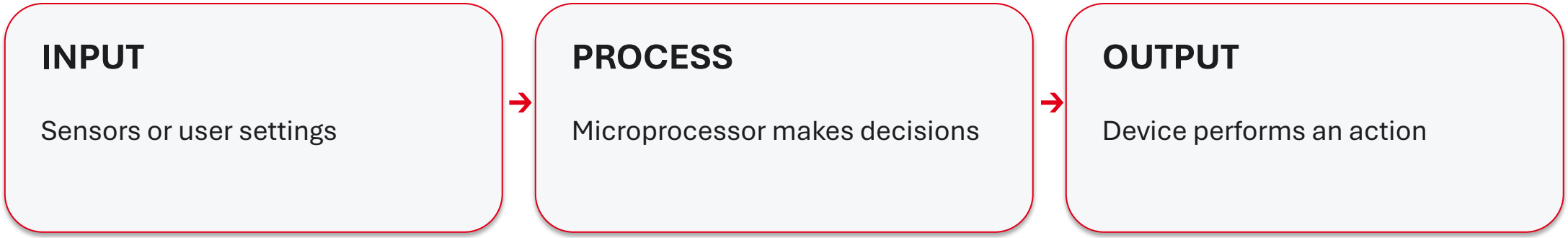
WHAT IS A MICROPROCESSOR-CONTROLLED DEVICE?

A device with a microprocessor that receives information, processes it and controls functions automatically.

Examples: washing machine cycles, heating thermostats, smart refrigerators and automatic alarms.

Key distinction: some devices save labour; others add functionality.

HOW A SMART DEVICE WORKS



Example: a thermostat detects low temperature → processes the reading → switches on heating.

HOME DEVICES: TWO GROUPS

Labour-saving	Washing machine, dishwasher, robot vacuum
Cooking and food	Microwave, cooker, bread maker, smart fridge
Convenience / entertainment	Television, alarm clock, home entertainment
Communication / climate	Phone, tablet, heating and air-conditioning

LIFESTYLE, LEISURE AND FITNESS

Positive: household tasks are automated, freeing time for hobbies, socialising and shopping.

Positive: remotely controlled cooking and washing can be more convenient.

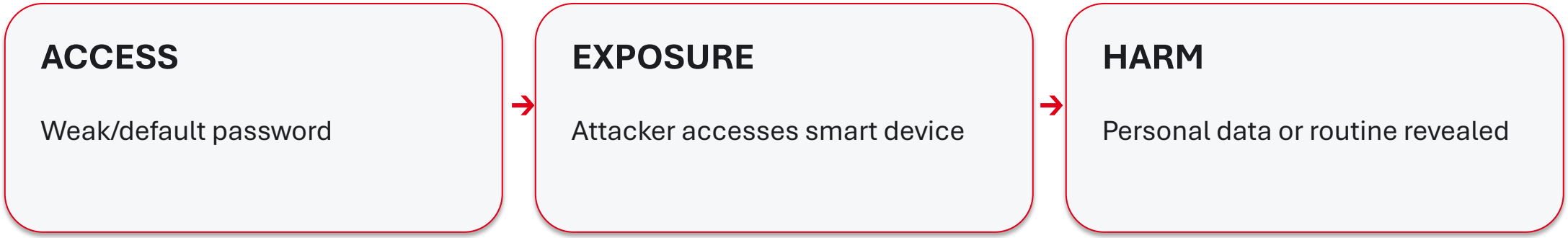
Negative: reduced manual work can mean less exercise and a less active lifestyle.

Negative: overdependence may reduce practical household skills.

SMART HOME: ADVANTAGE OR DISADVANTAGE?

Remote washing machine	Convenient; possible security exposure
Smart refrigerator	Can help reduce food waste; stores personal data
Automatic burglar alarm	Improves security; needs safe configuration
Standby television	Convenient; can waste electricity
Discarded electronics	Replacement can increase electronic waste

SMART HOME SECURITY ATTACK



Protection: unique strong passwords, change defaults and keep software updated.

SOCIAL INTERACTION: CLASS DISCUSSION

Consider the same smartphone in two situations:

A student uses video calling to keep in touch with family overseas.

Another student spends most free time online and rarely meets friends face-to-face.

Question: How can the same technology improve and reduce social interaction?

SMART MOTORWAY CONTROL

MONITOR

Cameras and traffic sensors

DECIDE

Central computer analyses traffic

RESPOND

Signs and signals change

Benefits: fewer delays and faster responses to congestion. Risks: hacking, failure and incorrect instructions.

SMART MOTORWAY SIGNS



Dynamic signs can display speed limits, warnings and lane information.

Discuss: What might happen if the central system fails?

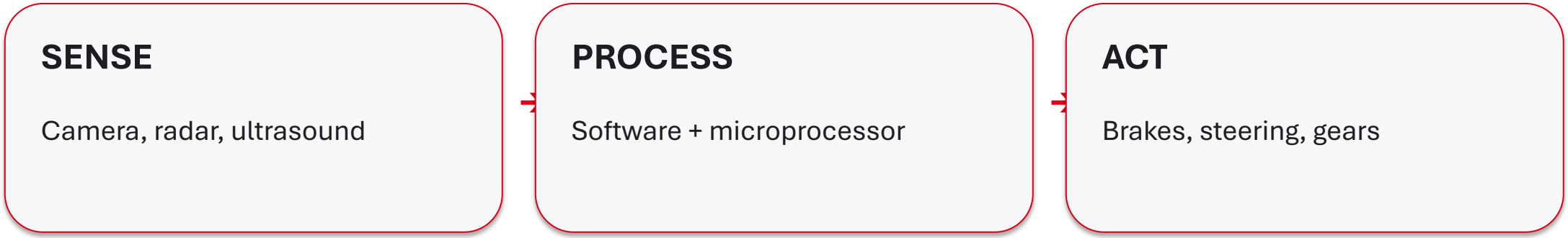
TRANSPORT MONITORING SYSTEMS

Traffic lights	Automatically adjust or coordinate road traffic
ANPR	Reads vehicle registration plates
Congestion zones	Monitor vehicles entering designated areas
Rail signalling	Coordinates safe train movements
Air traffic control	Helps manage aircraft movement

TRANSPORT: BENEFITS AND RISKS

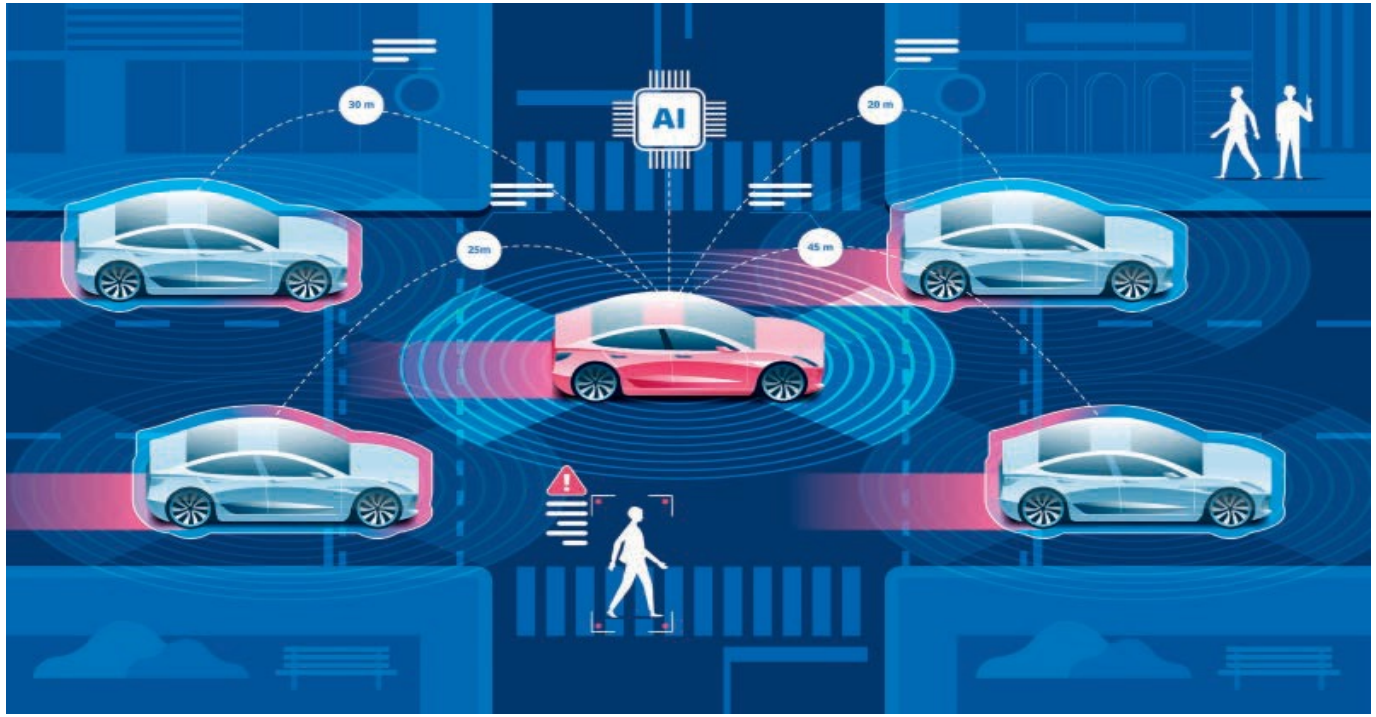
Traffic efficiency	Less congestion ↔ failure may cause disruption
Safety	Less human error ↔ poor design may be unsafe
ANPR	Detects offences/stolen vehicles ↔ privacy concerns
Computer networks	Coordinated service ↔ hacking vulnerability

AUTONOMOUS CAR: CONTROL LOOP



This is a continuous feedback process: the vehicle repeatedly senses its environment and adjusts actions.

AUTONOMOUS VEHICLE SENSORS



The source diagram shows sensors surrounding an autonomous car.

Look for objects, other vehicles and pedestrians.

RED TRAFFIC LIGHT: DECISION

DETECT

Camera sees red light

DECIDE

Control software identifies stop

ACT

Brakes are applied

RECHECK

Move only when safe

The system must also monitor pedestrians, nearby vehicles and changing traffic conditions.

AUTONOMOUS CARS: EVALUATION

Safety	Less human error ↔ software faults
Traffic	Smoother flow ↔ complex road situations
Cost	Potential efficiency ↔ high setup costs
Employment	Less driving required ↔ possible job losses
Security	Connected functions ↔ hacking or sensor spoofing

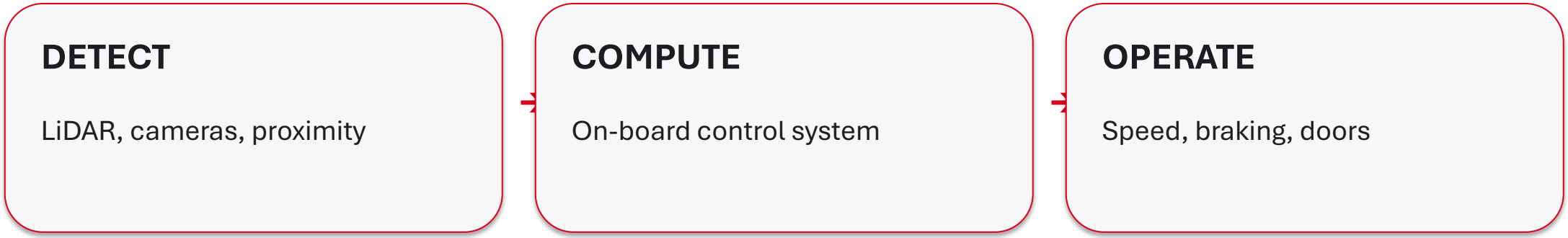
AUTONOMOUS TRAINS



Driverless trains use sensors, cameras, on-board computers and actuators.

LiDAR uses laser light to map surroundings.

DRIVERLESS TRAIN: CONTROL



Advantages: punctuality, energy efficiency and flexible scheduling. Limitations: cost, security and passenger behaviour.

PILOTLESS AEROPLANES

Inputs	Turbulence, pressure and other sensors
Navigation	GPS and on-board computers
Outputs	Actuators operate throttle, flaps and rudder
Potential benefits	Lower staffing costs, consistent control
Risks	Emergencies, cyberattacks, glitches, acceptance

HEALTH RISKS: CAUSES

Back and neck strain	Prolonged sitting and poor posture
RSI	Repeated keyboard/mouse movements
Eyestrain	Long screen use, glare and lighting
Headaches	Reflections, flicker and poor lighting
Ozone irritation	Laser printers in poorly ventilated areas

ERGONOMIC WORKSTATION

CHAIR

Adjustable, supportive

SCREEN

Appropriate height and tilt

HANDS

Neutral wrists, comfortable reach

Use a footrest if needed and take regular breaks to move and stretch.

PREVENTION: MATCH THE RISK

Back / neck strain	Adjust chair, monitor height and footrest
RSI	Correct posture, wrist rest, breaks, ergonomic input
Eyestrain	Reduce glare, breaks and eye checks
Headaches	Improve lighting, reduce reflection, breaks
Ozone irritation	Ventilation, printer room, inkjet alternative

EXAM QUESTION 1 • HOME DEVICES [6]

Give three advantages and three disadvantages to an individual of using microprocessor-controlled devices in the home.

Think about leisure time, fitness, skills, energy and data security.

Teacher prompt: Require six distinct developed points where appropriate.

EXAM QUESTION 2 • HEALTH [6]

Discuss methods a student could use to minimise health problems from prolonged computer use.

Include: adjustable chair and screen, ergonomic input devices, lighting and glare, regular breaks, and eye tests.

Challenge: explain why each method helps.

EXAM QUESTION 3 • SECURITY [4]

Describe security issues caused by internet-connected home devices and explain how to reduce the risks.

Include a realistic example of personal information exposure.

Explain strong unique passwords and software updates.

EXAM QUESTION 4 • SMART ROADS [6]

(a) Describe three advantages of monitoring and controlling major roads with smart signs. [3]

(b) Describe three risks of computer-controlled road systems. [3]

Consider congestion, human error, hacking, failure and privacy.

QUICK CHECK • TRUE OR FALSE

Microprocessors always reduce waste.	False
Automatic systems can save energy.	True
A smart television is labour-saving.	False
Connected devices cannot be hacked.	False
Smartphones affect social interaction.	True

FINAL CHAPTER RECAP

1 Home microprocessor devices: lifestyle, leisure, fitness, security and social impact.

2 Transport monitoring: smart signs, ANPR, efficiency, safety and privacy.

3 Autonomous cars, trains and aircraft: sensors, processing and actuators.

4 Health risks: back/neck strain, RSI, eyestrain, headaches and ozone irritation.

5 Exam skill: explain both benefits and drawbacks using specific examples.