

5.1.2 Smart Devices in Transport

Syllabus 2026 - 2028

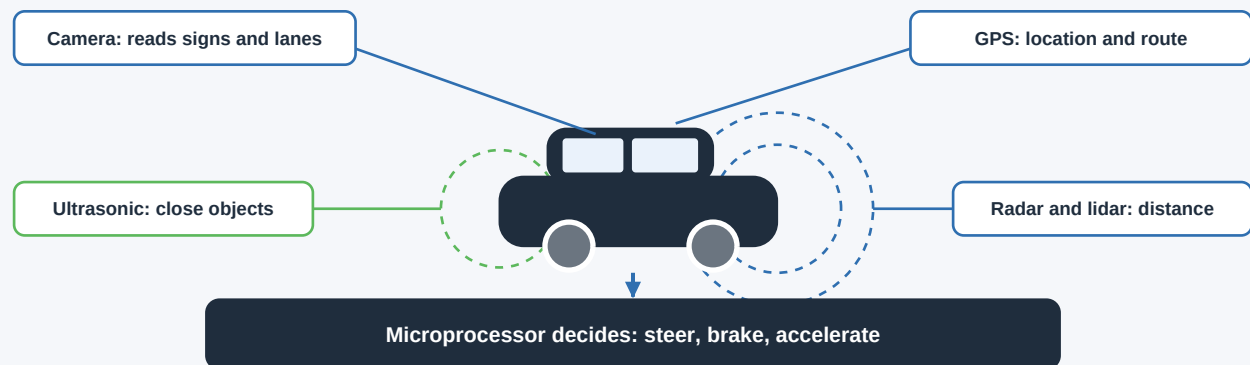
WHAT YOU NEED TO KNOW

- The positive and negative effects of microprocessors and smart devices in monitoring and controlling transport
- Security of data, autonomous vehicles and transport safety

Microprocessors in transport

Microprocessors monitor and control many parts of modern transport: car engines, anti-lock brakes, cruise control, parking sensors, satellite navigation, traffic lights, train signalling and the autopilot on aircraft. In an **autonomous vehicle** (self-driving vehicle), the microprocessor uses sensors and software to drive with little or no help from a person.

Figure 14: How an autonomous vehicle senses its surroundings



- **Sensors:** cameras read road signs and lane lines; radar and lidar measure the distance to other objects; ultrasonic sensors detect nearby objects; GPS gives location
- **Processing:** the microprocessor compares the readings with its maps and rules and decides what to do
- **Actuators:** the vehicle steers, brakes and accelerates as instructed

Positive and negative effects

Area	Positive effects	Negative effects
Transport safety	Systems such as automatic emergency braking and lane warnings react faster than a person. They are not tired, distracted or affected by alcohol, so human-error accidents are reduced.	A software fault or failed sensor can cause an accident. Sensors can fail in heavy rain, fog or snow. Drivers may rely too much on the system and pay less attention.
Autonomous vehicles	People who cannot drive, such as the elderly or disabled, can travel. Travellers can use the time for other things. Vehicles can keep steady speeds and distances, which eases congestion and saves fuel.	Very expensive technology. Drivers such as taxi and lorry drivers may lose their jobs. People may lose driving skills. It is difficult to decide who is responsible after a crash.
Security of data	Real-time information helps with navigation, traffic and maintenance alerts.	Vehicles collect location and journey data that can be tracked, hacked, shared or sold. A hacker may take control of a connected vehicle or its systems.
Efficiency and environment	Better routes, smoother driving and optimised timetables save time and fuel and reduce pollution. Traffic lights adjust to traffic.	Vehicles need a lot of computing power and updates; systems can fail if there is no signal or power.

EXAM TIP

For autonomous vehicles, name the **sensor** and what it does, then link it to a **safety** effect. When a question mentions data, talk about **tracking, hacking and privacy** of the location and journey data.

Key terms

Term	Meaning
Autonomous vehicle	A vehicle that drives itself using sensors and software.
Lidar	Sensor that measures distance using laser light.
Radar	Sensor that measures distance using radio waves.
Ultrasonic sensor	Sensor that detects close objects using sound waves.
GPS	Global positioning system; gives location from satellites.
Cruise control	System that keeps a vehicle at a set speed.
Anti-lock brakes	A system that stops wheels locking when braking.
Connected vehicle	A vehicle that exchanges data over a network.

Practice questions

Answer each question in full sentences. Command words used: State (give a short answer), Describe (say what it is like), Explain (give reasons), Analyse (break it down and examine it), Suggest (apply your knowledge to a situation), Compare and contrast (similarities and differences), Evaluate (weigh up and reach a judgement).

No.	Question	Marks
1	State two sensors used in an autonomous vehicle.	[2]
2	Describe how an autonomous vehicle uses sensors and a microprocessor to avoid hitting another vehicle.	[3]
3	Explain why data security is a concern for vehicles that are connected to the internet.	[2]
4	Compare and contrast a car driven by a person with an autonomous vehicle in terms of transport safety.	[4]
5	Evaluate the use of autonomous vehicles for public transport.	[6]

Total: 17 marks