

Markscheme

November 2024

Digital society

Higher and standard level

Paper 2

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1. State the drone privacy laws in:

(a) Algeria [1]

Outright ban.

Award [1] for identifying the drone privacy law in Algeria.

(b) Namibia [1]

Visual line of sight required.

Award [1] for identifying the drone privacy law in Namibia.

2. Using Source B, explain **two** characteristics of drones that enable them to successfully deliver packages. [4]

Answers may include:

- Accelerometers
- used to determine position and orientation of the drone in flight.

- Gyro/gimbal/ tilt sensor
- provide input to flight-control system to maintain level flight.

- Magnetometers
- indicates the direction of the magnetic field to verify heading

- Weight sensors / sensor to determines weight of packages
- determines weight of packages during delivery

- Lidar/Ultrasonic sensor /sensor that uses laser to measure range and depth
- to detect distances to release package safely.

- GPS/GNSS
- to find locations and keep on track

- Camera
- views keep it safe and on track

- Onboard computer/ Algorithm
- to control activity (some degree of autonomy).

Award [1] for identifying each characteristic that enables drones to successfully deliver packages and [1] for an explanation (why/how) it enables drones to successfully deliver packages up to [2] marks.

Mark as [2] + [2].

3. Compare and contrast what Source C **and** Source D reveal about the impacts and implications for citizens arising from the use of drones.

[6]

Answers may include:

Compare

Access:

- Source C discusses how health workers use drones to access hard-to-reach remote areas with drones; **likewise**, Source D uses drones to obtain an ariel view of fire-stricken sites that are hard to view. **Implications** - both drones go to areas which may be unsafe for people.
- Source C discusses drones as part of a government initiative ie delivering health care and law enforcement; **likewise**, Source D uses drones as part of a government initiative to support arson investigations. **Implications** – both benefit citizens by saving lives, but there is a cost to taxpayers in both cases.

Ease of access:

- Source C provides examples of the ease of access to drones for vaccine deliveries. **Likewise**, Source D provides examples of tracking potential fires with the use of drones. **Implications** – both benefit citizens by saving lives in areas that may be inaccessible.

Monitoring/ Data Collection:

- Source C uses drone images of the flooded terrain for the World Health Organization to help determine areas in distress, **likewise**, Source D uses images to provide aerial views of sites where arson may have taken place. **Implications** – both benefit citizens by saving lives in areas by collecting data for future development.

Contrast

Legal issues:

- Source C uses drones to support the work of healthcare workers, **whereas** Source D could infringe upon the privacy rights of individuals as it uses images to catch people responsible for starting the fires. **Implications** – how the data is used can be a concern.

Privacy concerns:

- Source D has concerns about the privacy of capturing video footage, **whereas** source C has no concerns as they are used in remote areas. **Implications** – how the data is used can be a concern.

The following markbands should be used with responses to question 3.

SL and HL Paper 2, question 3	
Marks	Level descriptor
0	<ul style="list-style-type: none"> The response does not reach a standard described by the descriptors below.
1–2	<ul style="list-style-type: none"> The advantages/disadvantages or specific points from each source for specific individuals are identified. The comparison/contrasts of points/ideas drawn from C and D about the use of drones then move to a 2. (whereas, while...)
3–4	<ul style="list-style-type: none"> The impacts (effects and outcomes) and implications (opportunities and risks) for citizens must be stated. Comparisons AND contrasts are linked to the impacts and implications on various citizens mentioned in the sources, such as hard-to-reach citizens requiring medical pharmaceuticals or test results, local health workers (Source C), police, fire crews, people/people with property at risk (Source D) The reference to the sources may be implicit.
5–6	<ul style="list-style-type: none"> The impacts and implications are further developed from the examples provided in Sources C and D to explore broader effects, outcomes, opportunities, and/or risks for citizens in general. Brief comments would be a 5 and with details demonstrating an in-depth understanding would be a 6. There should be explicit references to the sources.

4. With reference to Sources A–D **and** your own knowledge, to what extent do you agree that the use of drones by a government in health care and the prevention of arson outweigh the concerns?

[12]

Answers may include:

Advantages:

Accessibility: (Political)

- Can easily fly to a specific location with accuracy (Sources B, C and D).
- Easy access to remote areas (Source C, Source D).
- Images on drones could identify new problems/issues not previously known (Source D).
- Faster response time - drones are easily deployed, be no issues with traffic and congestion, shortest routes calculated (Sources B, C and D).

Convenience: (Social)

- Drones be used without the need of humans (Sources B, C and D).
- Drones be used anytime, 24/7 (Sources B, C and D).

Reduced Costs (Economic)

- Drones are cheap to purchase and operate - battery-powered, with no expense for fuel (Source B).
- Reduced labour costs - drone delivery operation is fully autonomous (Source B).

Environmentally friendly (Environment)

- reducing carbon footprint - helps reduce their fuel costs and fight climate change (Source B).

Concerns:

Accessibility: (Political)

- Drones are banned in some countries (Source A).
- Drones can only fly with limited visual sight (Source A).
- Package weight is limited to 2 kg, therefore limiting what can be delivered (Source B, Source C).
- Drones have height restrictions, 60 meters, therefore limiting some areas (Sources B, C and D).
- Drones may not be able to fly in certain conditions due to weather (e.g. windy conditions) (Source C, Source D).

Privacy: (Identity, human knowledge)

- Privacy concerns need to be addressed (Source D).
- Who owns the data on the drones? (Source D).
- Who has access to the drone data? (Source D).
- Who is accountable if a data leak occurs? (Source D).
- Drone camera is continuously recording during the delivery- which poses privacy issues (Source C).

Security: (Human knowledge)

- Can drones be hacked? What security is in place to stop unauthorized access to data and manipulation of data? (Source D).
- computer system that controls drones will need to be protected from hackers to prevent theft and the protection of property (Source C).
- malfunctioning of drone - damage if a drone falls from the sky (Sources B, C and D).

Rules and Regulations: (Identity, Power, Values and Ethics)

- Different privacy laws from one geographical area to the next, (Source A).
- Strict regulations to keep track of issues such as altitude, range, navigable airspace, weight, and current privacy laws (Source B).
- there might not be enough room up in the sky for hundreds or even thousands of delivery drones.
- ensure drones won't endanger people or property (Source A, Source B).
- lobbying governments to ease regulations to make it easier to run a drone delivery service (Source A).

Reliability: (Systems)

- drones crash - items will get ruined by the travel (Source C).
- drones deliver items to the wrong address (Source C).
- packages left unattended - making stealing easier (Source C).
- packages may not have a safe landing area (Source C).

Acceptance: (Change)

- the skies will be cluttered with noisy technology (Source A).
- Drones may be harmful to the public (Source D).
- Delivery by a drone/robot rather than an actual person (Source C).

Costs (Economic)

- Initial cost of infrastructure for a drone delivery network will be expensive (Source C).
- Costs to train staff to operate the system (Source D).

3Cs	From the guide	Suggestions of what we are looking for in the response
Context	Cultural Economic Environmental Health Political Social Human knowledge	<p>Economic: costs to develop and maintain drone networks vs long term savings with decrease crime/increase, cheap/quick transport alternative</p> <p>Health, reduced labour costs, training costs</p> <p>Political: Privacy laws, government regulations (Source A), crimes/law breaking, surveillance and monitoring.</p> <p>Social: Demographics/population spread, social class (4.7B),</p> <p>Enviromental: lower carbon footprint, ewaste, noise pollution, skies cluttered with drones, prevent pollution (fires)</p> <p>Health: reduction in pollution with fires, medical research/wider collection of medical samples</p> <p>Human knowledge: data collection/patterns leading to scientific discovery</p>
Content	Data, Algorithms, computers, Networks and the internet, Media, AI Robots and autonomous systems	<p>Data: collection, storage, access (personal information, video capture, locations/medical needs,</p> <p>Robots and Autonomous Systems: Components of drones (sensors, video/cameras, communications, remote access/control, line of sight, onboard computation – reliability issues of drones</p> <p>Arson: AI technology - thermal and optical imaging to automatically detect and assess fires, relaying critical information to fire teams on the ground</p> <p>Source: With permission from CTIF.</p> <p>Swarm technology Cameras for tracking potential criminals</p>
Concepts	Change, identity, expression, power, space, systems, value and ethics	<p>Change: new approaches to healthcare and crime prevention</p> <p>Identity: representation</p> <p>Power: regulation/laws, influence, access/use of data/drones</p> <p>Space: physical borders/geographical restrictions, access</p> <p>Systems: reliability (interdependent connections), accuracy</p> <p>Value and ethics: privacy, security, design (bias), decision making</p>

The following markband should be used for responses to Question 4.

SL and HL Paper 2, question 4	
Marks	Level descriptor
0	<ul style="list-style-type: none"> • The work does not reach a standard described by the descriptors below.
1–3	<ul style="list-style-type: none"> • The response shows a limited understanding of the demands of the question. • There is limited relevant knowledge. • Evidence from sources is not integrated with the response. • The response has limited organization.
4–6	<ul style="list-style-type: none"> • The response shows some understanding of the demands of the question. • Some knowledge is demonstrated but this is not always relevant or accurate. • Evidence from sources is partially integrated into the response. • The response is partially organized.
7–9	<ul style="list-style-type: none"> • The response shows adequate understanding of the demands of the question. • Relevant and accurate knowledge is demonstrated with some lapses. • There is adequate integration of evidence from the sources, but this is not always sustained. • The response is adequately organized.
10–12	<ul style="list-style-type: none"> • The response is focused and shows an in-depth understanding of the demands of the question. • Relevant and accurate knowledge is demonstrated throughout, adding insight to the response. • There is consistent and effective integration of evidence from the sources. • The response is well-structured and effectively organized.
