Épreuve du 1er groupe

A N G L A I S

Bird-Inspired Drone Can Jump for Take-Off

Researchers in Lausanne have built a drone that can walk, hop, and jump into flight with the aid of birdlike legs, greatly expanding the range of potential environments accessible to unmanned aerial vehicles. RAVEN (Robotic Avian-inspired Vehicle for multiple Environments) was conceived in Lausanne's School of Engineering by the Laboratory of Intelligent Systems (LIS). Designed based on perching birds like ravens and crows that frequently switch between air and land, the multifunctional robotic legs allow it to take off autonomously in environments previously inaccessible to winged drones. "Birds were the inspiration for airplanes in the first place, and the Wright brothers made **this dream** come true, but even today's planes are still quite far from what birds are capable of," says researcher Won Dong Shin. "Birds can transition from walking to running to the air and back again, without the aid of a runway or launcher. Engineering platforms for **these kinds of movements** are still missing in robotics."

RAVEN's design is aimed at maximizing gait diversity while minimizing mass. Inspired by the proportions of bird legs (and lengthy observations of crows on university campus), Shin designed a set of custom, multifunctional avian legs for a fixed-wing drone. He used a combination of mathematical models, computer simulations, and experimental iterations to achieve an optimal balance between leg complexity and overall drone weight (0.62kg). The resulting leg keeps heavier components close to the 'body', while a combination of springs and motors mimics powerful avian tendons and muscles. Lightweight avian-inspired feet composed of two articulated structures leverage a passive elastic joint that supports diverse postures for walking, hopping, and jumping.

"Translating avian legs and feet into a lightweight robotic system presented us with design, integration, and control problems that birds have solved elegantly over the course of evolution," Floreano says. "This led us to not only come up with the most multimodal winged drone to date, but also to shed light on the energetic efficiency of jumping for take-off in both birds and drones." Previous robots designed to walk have been too heavy to jump, while robots designed to jump did not have feet suitable for walking. RAVEN's unique design allows **it** to walk, traverse gaps in terrain, and even to jump up onto an elevated surface 26 centimeters high.

Adapted from www.sciencedaily.com/releases/2024/12/241206111951.htm

I. TEXT COMPREHENSION *(10 marks)*

A) Complete the following statements with information from Paragraph 1. *(03 marks)*

1. The technology that allows the RAVEN drone to "expand the range of potential environments accessible to unmanned aerial vehicles" is its _____ *(write two words only)*.

2. Birds were the inspiration for airplanes in the first place and _____ were the inspiration for RAVEN *(write three words maximum)*.

3. Contrary to birds, airplanes need the aid of a runway or launcher to _____

_____

B) Sentences a⇨e below are from Paragraph 2. Four (4) of them correspond to the four ideas (4-7) in the table. Write a letter (a, b, c, d, or e) under each idea to indicate the correspondences. *(02 marks)*

a) Inspired by the proportions of bird legs and lengthy observations of crows…
b) He used … of mathematical models, computer simulations, and experimental iterations…
c) …to achieve an optimal balance between leg complexity and overall drone weight.
d) The resulting leg keeps heavier components close to the 'body'.
e) Lightweight avian-inspired feet composed of two articulated structures leverage a passive elastic joint that supports diverse postures for walking, hopping, and jumping.

Ideas Expressed			
4. Drone's manner of functioning	**5.** Technique employed by Shin in the design	**6.** Shin's major design objective	**7.** Origin of the RAVEN idea

C) Read Paragraph 3. Then classify phases W-X-Y-Z below from the most ancient to the most recent. Write 'N° 1', 'N° 2', 'N° 3', and 'N° 4' to indicate their chronological order. *(02 marks)*

8. **Phase W:** The researchers translated avian legs and feet into a lightweight robotic system: _____
9. **Phase X:** Birds solved design, integration, and control problems elegantly: _____
10. **Phase Y:** RAVEN becomes the most multimodal winged drone to date: _____
11. **Phase Z:** Previous robots were designed to walk and previous robots designed to jump: _____

D) Indicate WHAT the phrases 'this dream,' 'these kinds of movements' and 'it' refer to. *(03 marks)*

12. "this dream" (Line 8): ☞ _____
13. "these kinds of movements" (Line 11): ☞ _____
14. "it" (Line 25): ☞ _____

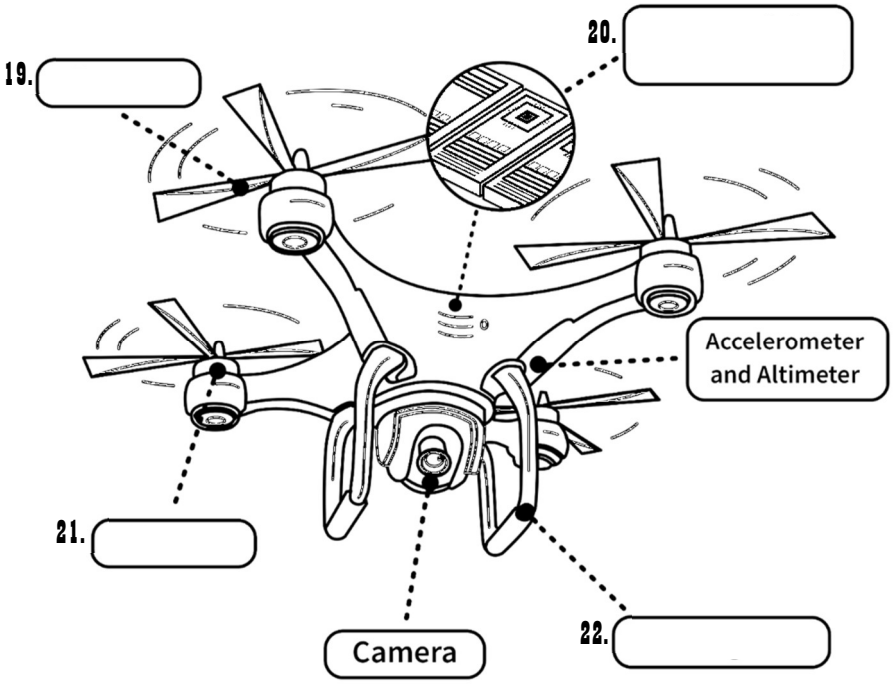
II. LINGUISTIC and COMMUNICATIVE COMPETENCE *(06 marks)*

E) Choose the correct option in parentheses to fill in each gap in the description below. *(02 marks)*

Fixed-wing drones that take advantage of legs for short takeoffs and landings are not an entirely new idea. In 2019, a startup called Passerine designed a drone called Sparrow that used a pair of spring-loaded legs to jump (**15**) _____ *(into ❁ over ❁ on)* the air and take flight from a standstill. What makes RAVEN different is the complexity of its legs that allow the drone to walk across rough terrain, jump over craters, and hop onto obstacles as high as ten (**16**) _____ *(meters ❁ kilometers ❁ inches)* — in addition to being able to leap into flight. RAVEN's operations are not limited to airports or areas with smooth surfaces. It is capable of (**17**) _____ *(to land ❁ landing ❁ lands)* in areas that may be dangerous or restricted to humans, and then repositioning itself to an area that is safe for takeoff. And it does it all using (**18**) _____ *(more ❁ lesser ❁ less)* power than a quadcopter drone would, giving it a larger operational range.

Adapted from https://www.theverge.com/2024/12/6/24314771/epfl-uc-irvine-drone-raven-aircraft-research-science

F) Use the information in the description text to complete the labels in the picture legend. *(02 marks)*



Motor: A motor drives the propellers and enables movement. This generates thrust to lift and control the drone.
Landing Gear: It is the structure that supports the drone when it is on the ground and protects it from damage during landing.
Propeller: Propellers are the rotating blades that push air up or down. They are attached to motors.
Stabilizer: A stabilizer allows the drone to fly super smooth, which keeps the camera steady and level, even when the drone moves or experiences turbulences that may be caused by bad weather like rain or strong winds.
Data Link System: Drones use frequencies to transmit and receive data. This communication module provides a link between the air system and ground control.

Adapted from https://api.ctia.org/wp-content/uploads/2019/04/drone-illustration.png

G) In the interview excerpt below, Tony Finnergan responds to an AP journalist on drone usage. Choose from the questions in the box to complete the interview. One question will not be needed. *(02 marks)*

Q: And how can we get such permission?
Q: Okay! Now, if a drone user breaks the law, what may happen to them?
Q: What are the most common questions people ask about drones?
Q: Why do we need to talk about the potential dangers of flying drones?
Q: When do drone owners need permission to fly these small aircrafts?

Journalist: Thank you Tony for giving us the opportunity to hear from you. Here's my first question: What are the most important things that we should remember when flying drones?
Tony: Firstly, make sure you are at least 50 meters away from people, buildings, or anything you could come into contact with. Secondly, you should always have a line of sight of the drone.

Journalist: (23) _____?

Tony: It's important because we have seen a huge and growing interest in drones. So, users need to know that just like knives, drones also can serve as well as they can harm or cause damage.

Journalist: (24) _____?

Tony: That's a good question. You need that when you're using a drone in a professional capacity — like news broadcasting — or for commercial purposes.

Journalist: (25) _____?

Tony: You just need to get in touch with the CAA and they can advise you about getting permission.

Journalist: (26) _____?

Tony: They usually want to know about the basic rules, where they can fly their drones, and when they would need permission.

Adapted from https://amateurphotgrapher.com/latest/photo-news/drones

…/…4

III. WRITING *(04 marks)*

Choose ONE topic and write between 100 and 150 words about it.

Topic 1: Drone use is rapidly growing in many areas of modern life such as security, agriculture, and filmmaking. Discuss the benefits and challenges of using drones in today's world.

Topic 2: In 2018, a Boeing 747 carrying 455 passengers almost collided with a drone at Gatwick airport in London, just one minute after take-off. On a September afternoon, a flight carrying 186 passengers had just taken off from Manchester when suddenly a large, blue object flew right past the windshield, which indicates a serious risk of collision. In March 2020, Frankfurt Airport—one of Europe's biggest—was shut down for almost two hours after a drone was seen nearby. Considering all these incidents, what recommendations would you address ASECNA, the agency in charge of civil aviation security in Africa? What regulations measures do you think the Senegalese government should take to guarantee security and privacy in our airspace while allowing drone users to fly their tiny gadgets?

PS: Drone incidents reported at https://www.robinradar.com/blog/5-biggest-drone-incidents-at-airports-in-2020