Module 03.01a Parts & Purpose Student Guided Notes

At the end of this unit, students will be able to:

Describe_____ and

_____

Describe _____ and their_____ or _____

What is the basic equipment that all drone pilots will utilize?

The Drone
The drone is a _____ and we will be referencing its parts as basic
equipment to _____. We will focus our attention on
_____ as they are most familiar to our group, used
_____, and _____ available "off the shelf". _____ are available and
historically have been the precursor to the technologies in use today but our focus will
be on the _____.

We're reviewing hardware that is:
- off-the-shelf
- commonly used in mapping
- familiar to industry and practitioners

Equipment- Drone Parts
(Label the following using the link provided
https://www.dronefly.com/the-anatomy-of-a-drone)

Equipment- Drone Components

_____ - Inside the legs of the drone is the transmission system which relays information from the drone to the controller and from the controller to the drone.

Battery - The _____ for the drone. Drone batteries are '_____' meaning that they have _____ that helps with overcharge protection, temperature data, charge cycle history, and communication of power output to the drone. This helps the operator avoid _____ during flight and the efficient repeated charging and discharging of the battery through its expected life.

Camera / Sensor - The picture provided shows a camera but various sensors may be mounted on the gimbal or underside of the drone. _____ allow for the_____.

_____ / _____- The main purpose of the drone frame and chassis (or hull) is to provide _____ while also

providing enough _____ to fly, land, and provide durability. The top materials used in drones today are _____ (CRFCs) especially in the frames, and _____.

_____ -These flash various colors to show the user what direction the drone is facing. The two flashing red lights show the front of the drone. The two green flashing lights are the back of the drone. _____also help in notifying pilots of manned aircraft of the _____ presence. The safety lights have long-range visibility.

Gimbal; 3-axis - A motor is placed on the 3 different axes around the camera or sensor. When the sensors detect _____, the motors counteract the motion to cancel it. This happens almost instantly as thousands of calculations are executed to provide smooth footage and _____.

_____ - Landing Gear for drones provides additional _____. This can help _____. They can widen the drones "stance", allowing for a more _____ and landing..

Mini SD Disk Slot - While you can fly a drone without a mini SD card, _____ _____. 32GB or 64GB _____ are commonly used to collect image data.

_____ - The port used to connect the _____ to other equipment. While this port can be used to connect to the drone and read what's on the sd card, its primary use is to

_____.

Motors - DJI uses _____ (BLDC) motors for all of their drones. These are industrial motors designed for multirotor systems (equal number of _____ rotating and _____ rotating).

_____ - Front, rear, and bottom sensors are the main components of a drones _____. These are used to maintain position, hover indoors, and operate in areas where _____ signals are not available.

Propellers - Propellers have specific design consideration for each drone. Considerations include rotational _____, ___ of blade, _____ of blades, and ____ of blades. Propellers may have 2, 3, 4, and even five blades. Propellers, when turned by the motors, push air in a specific direction creating the propulsion needed for the aircraft to fly and maneuver.

_____- Real Time Kinematic positioning using Global Navigation Satellite System. GPS drones are equipped with a GPS module that allows them to know their location relative to a _____. RTK follows the same general concept, but RTK _____ station and a rover to reduce _____. The base station transmits correction data to the rover on a continuous basis allowing for the most accurate _____ of drone _____data.

The controller

The controller is _____ with the drone and works by sending _____ from the remote control to _____. The signal tells the drone what operation to perform (_____). Radio signals are sent from the radio _____ in the drone controller and received by the drone's _____ via _____ that are either visible or embedded within the drone and the controller let's look at a DJI Phantom 4 Controller to
  ● Identify its parts
  ● Describe basic components
While controllers may vary to some degree, operationally, a drone is piloted by a pilot on this piece of equipment as it _____.

Controller (DJI P4 Pro & Pro+ picture)
Pilot's Controls
Each _____ will have its own controller and will be _____ to it for pilot _____. Models vary by make and model of drone but all have some basic features needed for flight operations.

Using the Powerpoint of DJI Pro Manual PRovided list the parts and provide their description for the Sample Controller pictured below (1 to 24):

Phantom 4 Pro+ (Model: GL300E)

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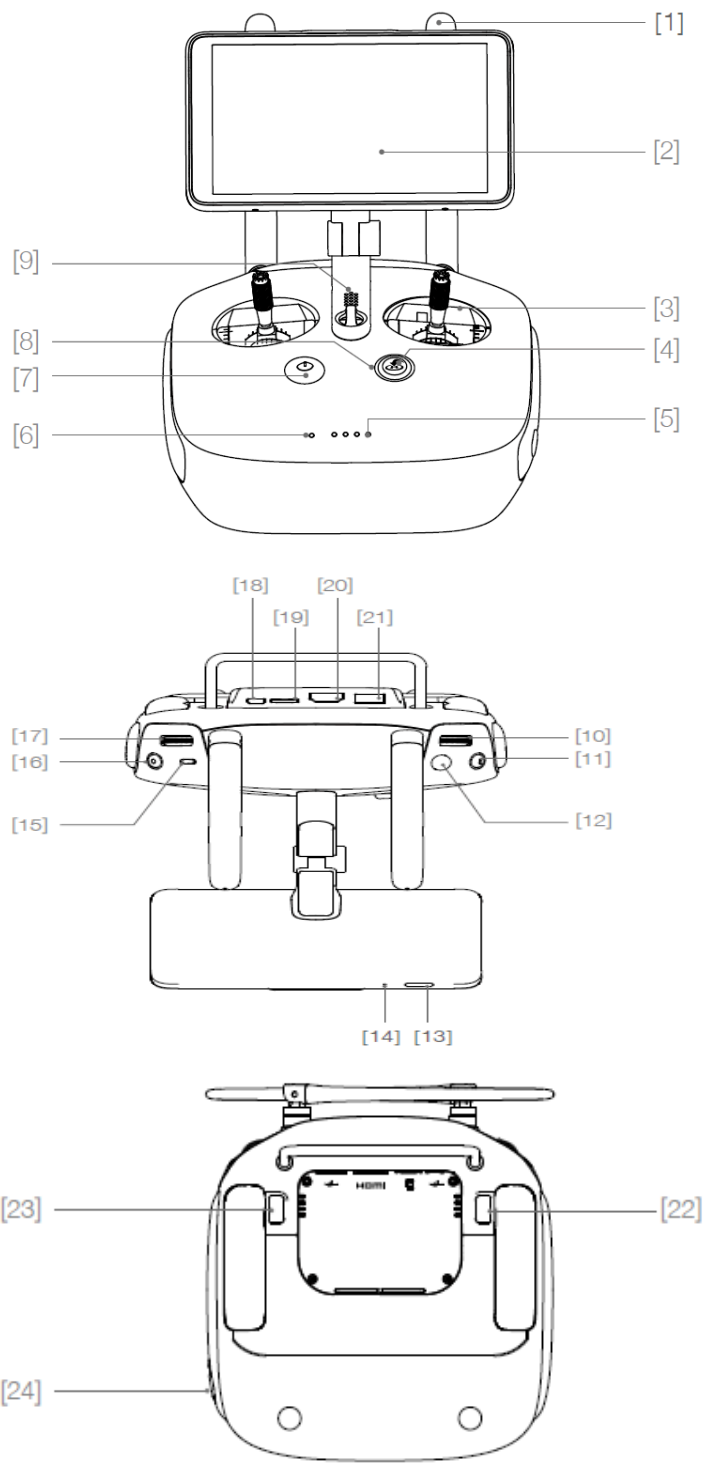
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The Camera and/or Sensors

Sensors and sensor technology is a _____ in Unmanned Aerial Vehicle (UAV). It is _____ for a drone to have many of the following sensor technologies embedded within. A 3 axis accelerometer sensor to help _____ the drone. A.gyroscope sensor is used to provide _____ motion to the drone. A Magnetometer sensor present in the drone that has ____ _____. A Barometer sensor (or _____) to determine the _____ of the UAV. A GPS sensor that uses satellites that have been launched around the earth to determine specific geographic locations. A Distance sensor used to help detect obstacles in the path of the UAV. There are more and the list is quite extensive. One could say that _____ are what have enabled UAVs to take flight and be utilized in the fashion that we rely on today. Our focus in this unit, however, is the camera or _____ we mount on our UAV to enable data _____ needed for _____ in the field.

The Camera is a _____

Cameras or Sensors mounted on our UAVs rely on specially made sensors to detect and convert _____ (EMS) waves into digital images that we can use to _____ problems or _____ useful artifacts. For better understanding, we will use the term "sensor" (and oftentimes the type of sensor, like "RGB") to address the equipment we mount on our UAV (_____) to capture _____ data.

To better understand the equipment and the work we do in agriculture with UAVs, it is important to share a basic introductory knowledge of the electromagnetic spectrum (EMS), both visible light rays and non-visible light waves. _____ provides a nice introduction for us to follow:
https://youtu.be/lwfJPc-rSXw

UAV Image sensors
One primary usage of UAVs, especially as it relates to _____, is to collect high quality images, from both _____ portions of the _____, in order to obtain a high level of detail and data that can be_____. This data can then be further processed to make good_____, detect trends and _____ changes or potential _____ that might arise.

The cameras and sensors used in UAV field can be categorized by the portion of the electromagnetic spectrum they utilize:

- V_____ = RGB – Visible To The Human Eye
- _____ = NIR – Mostly Invisible to the Human Eye
- _____ = IR – Invisible To The Human Eye
- _____ – Mixed Visible and Invisible wavelength channels

RGB sensors

A _____is basically a _____ (like the camera on your cell phone) that takes photographs or videos and _____ format on a _____. Unlike analog film cameras, which expose chemical film strips to light, a digital camera uses a _____ that converts light photons into _____ and that data is used to register an image. Below is a picture of the lens, image sensor, and image processing that occurs within a digital camera using visible light (image courtesy LUCID). For more information on digital sensors please visit: https://thinklucid.com/tech-briefs/understanding-digital-image-sensors/#
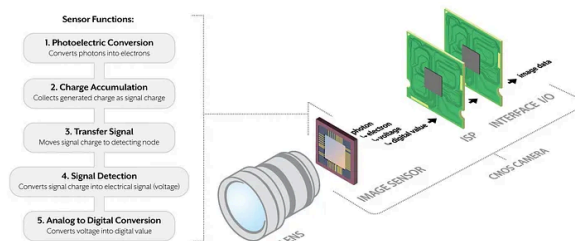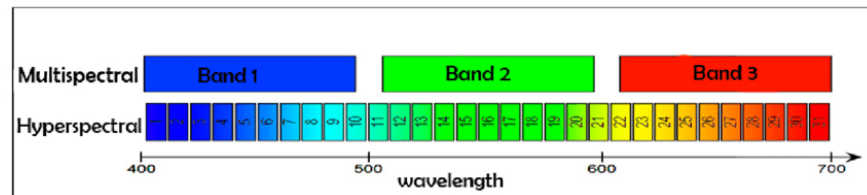

Near Infrared (NIR) & Infrared (IR) image sensors

_____ use sensors that work quite similar to that of _____, but they detect heat or wavelength energy that is _____. NIR (_____) is a part of the _____ that is _____ to the naked eye (wavelengths of about 650nm to 950nm) while Infrared radiation (IR), sometimes referred to simply as _____, is a region of the electromagnetic spectrum that is also _____ and has longer wavelengths (wavelengths of about 700 nm to 1mm). The NIR & IR response is free from _____. (Image courtesy of Optics for Hire)
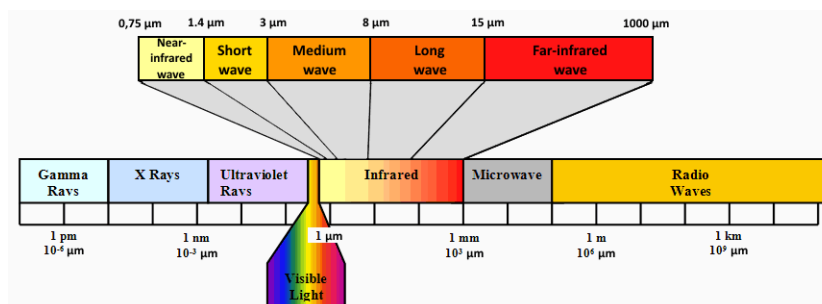
Multi-spectral image sensors

Multispectral imagery is produced by sensors that measure _____ within several specific sections (also called bands) of the _____. Multispectral sensors usually have between _____ different band measurements in _____ pixel of the images they produce. Examples of bands in these sensors typically include _____, visible red band, near infrared band, etc. _____ imagery consists of much narrower bands and discrete contiguous wavelengths or "_____" within the EMS bands. A hyperspectral image could have_____ of bands.

(Jasinski, et al., 2010)