Drones

In this lesson, students will be able to:

- Discuss uses for drones in agriculture
- Explore drone licensing and a pre-flight checklist
- Explore block coding to make an indoor classroom drone fly autonomously

Materials Needed:

- Tello Talent Indoor Classroom Drones
- iPads-one for each drone

Time to Complete:

Intro = 10 minutes

Activity = 30 minutes

Conclusion = 10 minutes

Introduction

Precision agriculture is a way of thinking where we are more intentional with our decision making. People who work in precision agriculture use technology with the intent to make more informed decisions as we strive to be more sustainable, efficient, and profitable. Drones are an up-and-coming technology that are utilized for several different purposes in agriculture.

Drone Uses in Agriculture

Agronomists, farmers, cooperatives, and drone companies utilize drones in agriculture. Below are some of the most popular uses for drones in agriculture currently.

1. Stand Count. Each year, agronomists and farmers try to understand the field's stand count. This shows them how well their seeds germinated and are growing. Sometimes a bad hybrid or a storm can cause population (the number of seeds planted per acre) to be lower than intended. The traditional way of calculating stand count is by hand counting a designated length of a row of corn plants. With

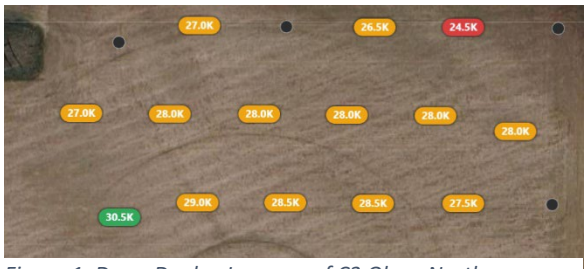

Figure 1. DroneDeploy Imagery of C3 Olson North on NECC's College Farm revealing stand counts.

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drones, we can now fly over a field and the drone can collect stand counts for us. This allows us to get a scope of the entire field, rather than just a few spots that we choose to count manually.

2. Mapping. The concept of mapping is gathering imagery of an entire field so the agronomist, farmer, or field manager can make decisions based on the entire field. Agronomists are responsible for covering a lot of acres, so they traditionally take their four-wheeler through a field and check the plants in a few places in the field. With drone imagery, they can fly the whole field to explore plant health. Areas that they identify in the imagery can then be ground truthed, which means they can drive out to that portion of the field to explore why it isn't as healthy. This is valuable to help agronomists cover more acres in the same amount of time. This process involves the drone snaking through the field anywhere from 200-400 feet above the ground, taking pictures every three seconds. It will capture 500-700 photos depending on height above ground and number of acres. Once the drone has captured those images, a software is used to stitch images together. Stitching software basically performs a puzzle; it looks for areas of similarity among pictures and makes one big photo for us to look at rather than 500 individual chunks. With this data, agronomists are able to again see the whole picture of a field rather than simply a small portion of the field that they would be able to walk to. With these pictures, they can see areas that might be struggling and need attention. They can then go and ground-truth those areas of the field.

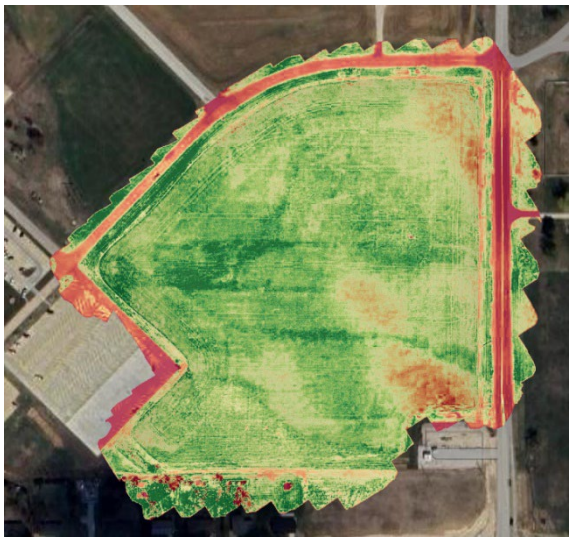

Figure 2. Mapped field on Northeast's campus. The individual photos have been stitched together to create this image for us.

3. Spraying. Spray drones are an up-and-coming technology. They are used to apply chemicals including fertilizer/herbicide/pesticide, etc. and for seeding such as cover crops. These spray drones weigh about 160 pounds when fully loaded and can hold about eight gallons depending on the drone model. They are an option for agronomists, spray companies, and applicators to use in odd-shaped or small fields where ground rigs or airplanes may not want to enter. This type of drone requires extra licensing and credentials to legally fly and operate.

Figure 3. DJI Agras Spray Drone

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Drone Licensing

You do, in fact, have to have your drone license to legally fly a drone for any reason in agriculture. You receive your drone license from the Federal Aviation Administration after getting a 70% or better on their exam. The official name for the drone license is the Part 107 Remote Pilot's Certificate. This exam costs under $200 and takes about two hours to finish. You can take this exam at an approved testing center, which can be found in Omaha, Lincoln, Kearney, North Platte, Scottsbluff, and Sidney in Nebraska. Your licensing is good for 24 months, and then you can retrain online.

Figure 4. Example of a Part 107 Remote Pilot's Certificate.

The license you receive is the size of your driver's license. You will want to keep it with you when you fly. One thing that is important to know is that you keep this card for life instead of getting a new one at renewal, so you will want to take care of it.

Pre-Flight Inspection

There are a variety of things to consider before you get the drone up in the air. Even in our activity, I want you to consider these things.

1. Physical Condition of the Drone: Are the propellers on tight? If you give them a slight tug with your fingers, they shouldn't come off easily. Does the battery appear to be in properly? No cracks or breaks.
2. Obstacles: where are my classmates standing? Where is the teacher standing? What sort of desks, tables, chairs, bleachers, basketball hoops, ceilings, walls, shelves, cabinets, etc. are in my area that I need to be aware of?
3. Is there a clear space for takeoff? If inside there is no wind, but wind is a huge deal if we go outside.
4. Do the people around me know I am about to tell the drone to take off? Communication is quite important!

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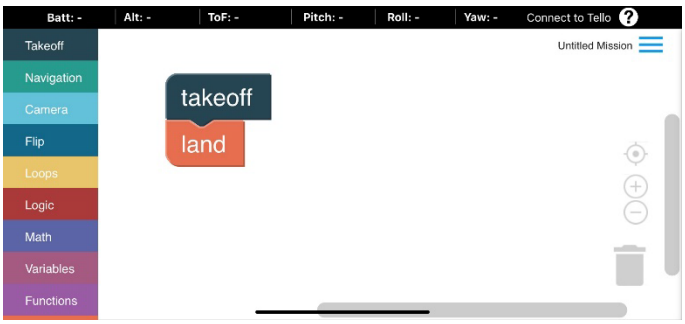
Activity

Today, we are going to “map” our own field using block coding. Block coding is a starting point for coding where we use blocks, that have different commands built in, to run something. In this case, to fly the drone. Using DroneBlocks, we are going to map a 60” by 60” field making three passes through the field. We will start in the southwest corner of the field, and when we are done with our three passes in the northwest corner, we will find the correct angle and the correct diagonal length to come back and land where we took off. We want to land where we took off because if we were truly flying a 160-acre field, we don’t have to walk across the whole field to pick up our drone.

We will use the Droneblocks app to build our code. The different commands available are on the left side of this screen. Drag the commands you want to use into your workspace. They link together like Legos.

We will use several different commands to achieve this:
Takeoff
*Fly forward _____ inches
*Yaw ____ degrees
Land
*We will use different combinations of these two lines to complete our code.



Build your code, and when you are done we will connect to the drone and fly them!

Conclusion

What are some ways we use drones in agriculture?

Would you buy a drone if you were a farmer? Why or why not?

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Would you buy a drone if you were an agronomist? Why or why not?

What other jobs would benefit from having a drone? Why?

What questions are you still pondering about drones?

Use this space to draw out your map or do any calculations:

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Image Links

Figure 2 from: How to get a Part 107 Remote Pilot (Video Drone) Certification (nextinymarketing.com)

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