



Robot Birds, Part 2

Motion Capture

Controlling the Flight of Miniature Vehicles Using Motion Capture Technologies



Dayton, OH (Wright-Patterson Air Force Research Lab)—Engineers use video-game technology to track motion and program computers to fly tiny flying machines. The goal is to eventually design micro air vehicles that will travel, navigate, and track in urban environments.

"It's a very exciting time to be a scientist or engineer." Ryan Carr, aeronautical engineer

Framework

Middle School

Standards

- NSES - B.ii.1 ➤ Motion can be measured and represented.
- NSES - B.iii.3 ➤ Light reflects off objects.
- STL - 2.M ➤ Technological systems.
- STL - 3.E ➤ A product or system developed for one setting may be applied to another.
- STL - 17.H ➤ Machine-to-machine communication systems.

Content Illustrated

- Small flying vehicles can be controlled by motion capture and computers.



Content



Physical Science

- ▶ Light can be reflected into a lens and transmitted as a signal to a computer.

Technology

- ▶ Engineers use the same motion capture cameras that the video game industry uses. Motion capture is a method for recording the video-game movement of people or objects and converting that information into a digital model.
- ▶ The special camera used has a ring of LED lights around its lens that shine red light. When light from the camera hits a marker dot placed on a person or object, the marker dot reflects the light back into the lens of the camera. Many cameras are used at the same time to track motion. All the information is fed into a computer.
- ▶ The computer generates a digital “skeletal model.” Graphic artists can make these models into realistic characters by drawing “skins” over them.
- ▶ Signals from motion capture are run through a real-time processor to program vehicle flight.

Engineering

- ▶ Air Force engineers are designing MAVs: small machines and robots that can fly into urban environments. MAVs could fly into various spaces to get close-up pictures of faces and objects.
- ▶ To understand how to control the flight of MAVs, engineers first perform tests on store-bought flying toys first. They use motion capture technology to track and model the flight of the toys.
- ▶ Testing is conducted in a large room that has many cameras mounted on all the walls.
- ▶ As part of testing, the engineers “teach” computers to fly the toys.
- ▶ As a result, the engineers can put marker dots on toys, program a computer for a few hours, and then tell the computer where to fly the toys. They can also make the flying toys follow (or track) other toy vehicles.
- ▶ Simple computer programming can tell a vehicle to track another object, turning motion capture into an aircraft control system.

Guiding Questions

To think about as you watch:

- ▶ How much information does a computer need to track the motion of an object? How much information would you need?

Suggested Activities

- ▶ Brainstorm about other ways to track and control small flying vehicles.

Keywords

micro air vehicles (MAVs)
light emitting diodes (LEDs)
microaviary
model
motion capture technology (mo-cap)
real-time processor

- ▶ *Robot Birds* can be found online at www.ndep.us/Robot-Birds-pt-2. Visit www.ndep.us/LabTV for a list of process skills modeled in webisodes.