EAGER: A Gateway Drone for High School Students

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Hypothesis

- Project-based learning through building, programming and using autonomous drones provides an engaging and exciting vehicle to increase interest in STEM, especially for students from underrepresented groups, by enhancing students' self-efficacy, attitudes, content knowledge, and skills of science practices.

Duckietown Sky
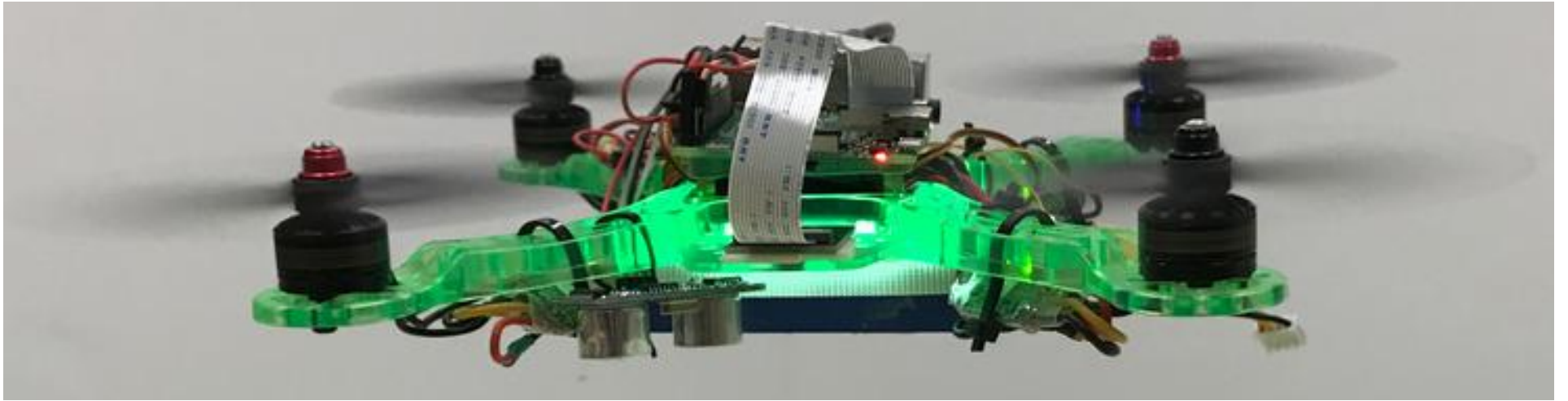
- Raspberry Pi/Python/ROS Autonomous Drone
- $225 in parts.
- All autonomy on-board in Python.

Curriculum

Topic	Description	Length
Robots and Society	History of robotics; Ethical use of robots; Robot safety	3 Hours
Electronics	Electronics; Soldering; Building the robot.	21 Hours
Computing and Networking	Python; Computer networking; GNU/Linux and Bash; ROS	7 Hours
Sensors and Actuators	Types of sensors; Reading sensor data; Publishing sensor messages; Types of actuators; Moving the robot	7 Hours
Closed Loop Control	Closed-loop and open-loop control systems; Proportional/Integral/Derivative (PID) control; Lane-following	5 Hours
Localization	Using a camera to estimate pose; Estimator uncertainty	3 Hours
	Total Class Time	46 Hours

Table 2: A summary of the topics covered in our curriculum and the class hours spent in each topic.

Education Initiative

- Summer 2020: Remote teacher training as standards aligned professional development.

- Fall: Distributed ~140 drones to high school students and teachers and two complete courses ran.

- Spring: Two more pilot courses running, and planning for next year.

- Measuring learning outcomes with a pre- and post-test as well as interest in STEM and self-efficacy.

Providence Career and Technical Academy

Results

- 11 teachers, 8 completed builds.

- Inconclusive learning gains for teachers for content knowledge. (We think the test was too long.)

- Learning gains for our first batch of students is pending.

- Four proposals written for follow-on work.