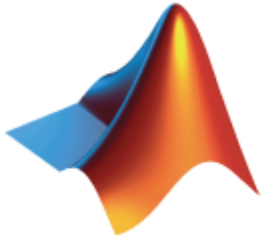


MATLAB and Simulink Robotics Arena

Drone Modeling, Perception and Control

Perception

Maitreyee Mordekar, MathWorks

During the Webinar

- Requirement:
  - Complete MATLAB Onramp
  - Complete Simulink Onramp
  - Complete Stateflow Onramp
  - See Video Series on Drone Simulation and Control

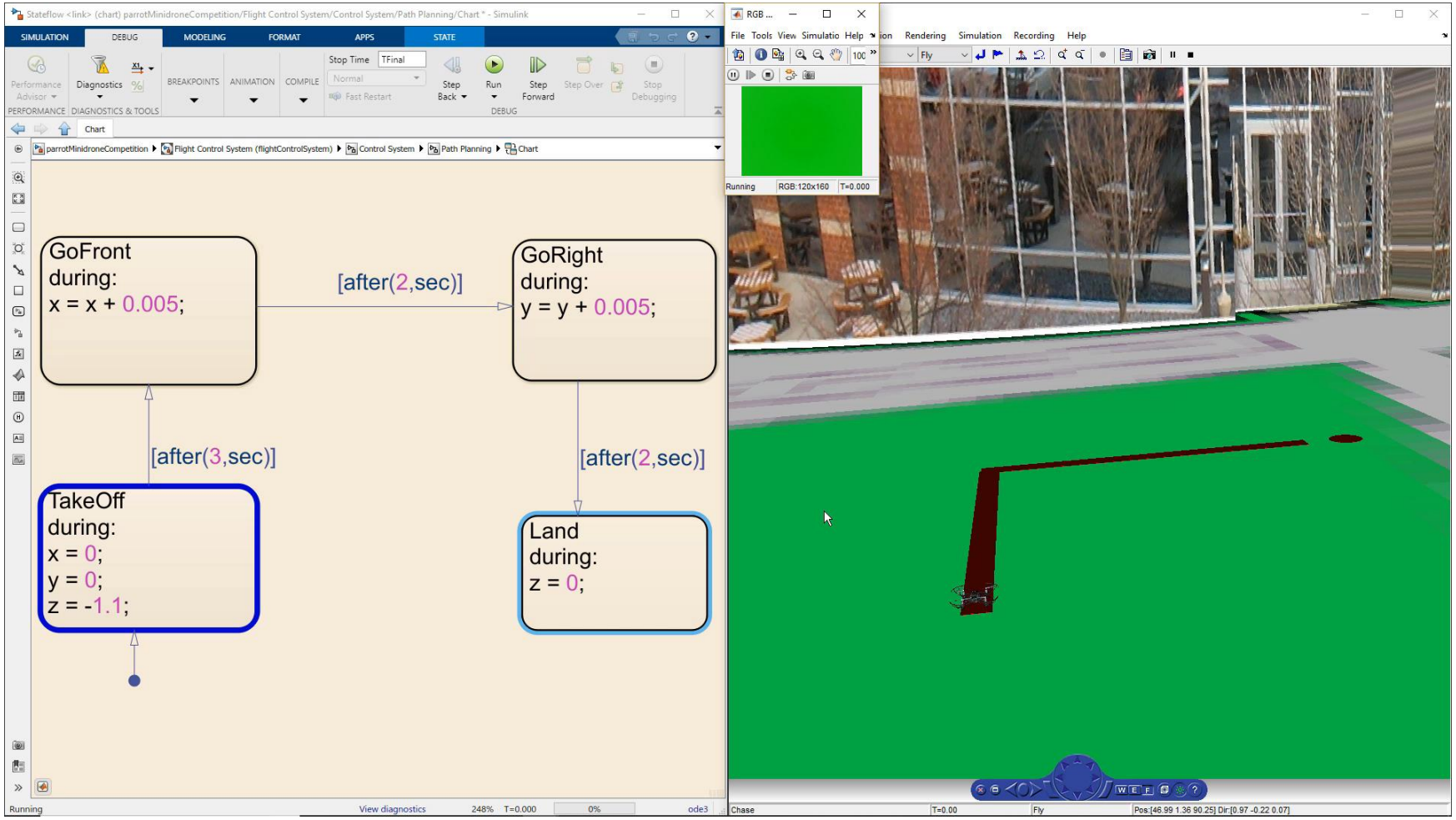
- ~45 minutes and open to questions

- For more questions:
  - minidronecompetition@mathworks.com
  - facebook.com/groups/RoboticsArena/

- Complete MATLAB Onramp
- Complete Simulink Onramp
- Complete Stateflow Onramp
- See Video Series on Drone Simulation and Control


Control
Perceive
Implement
Plan

Recap

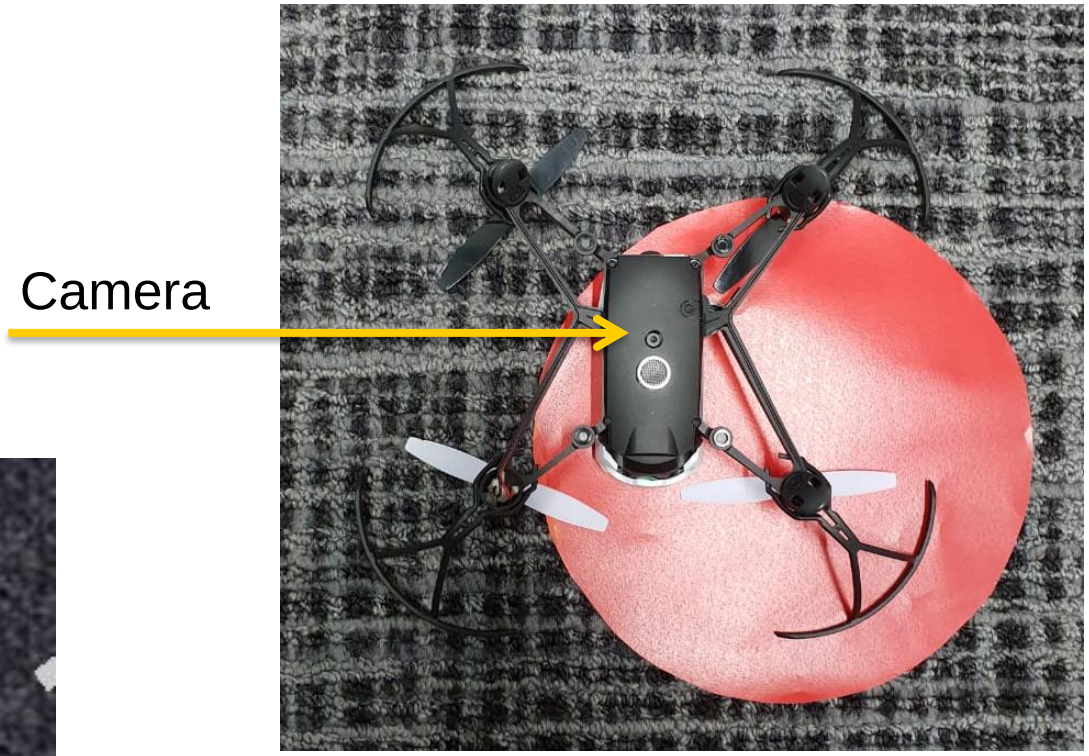

GoFront
during:
x = x + 0.005;
[after(2,sec)]
GoRight
during:
y = y + 0.005;
[after(3,sec)]
[after(2,sec)]
TakeOff
during:
x = 0;
y = 0;
z = -1.1;
Land
during:
z = 0;

Agenda

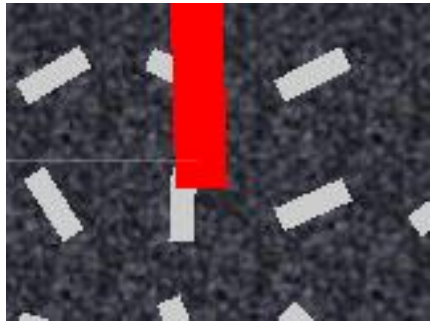
- Introduction to Image Processing
- Color Thresholding
- Image Processing using Simulink
- Follow a Red Line using Camera
- Explanation of a fun exercise
- How you can use drone for learning and teaching?

Camera Sensor

- Camera
  - To capture the view
  - To calculate horizontal velocities
- 120*160 image Y1UY2V format image



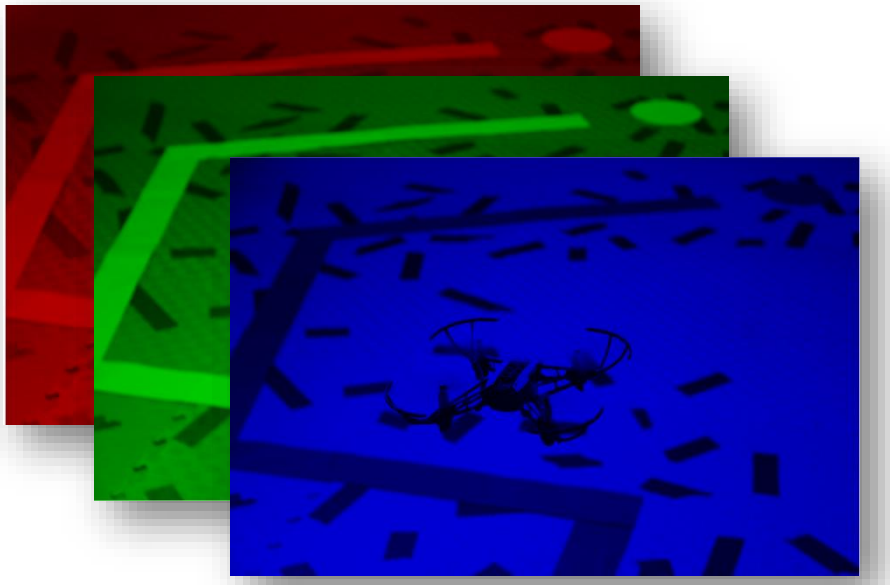
Real World Camera View

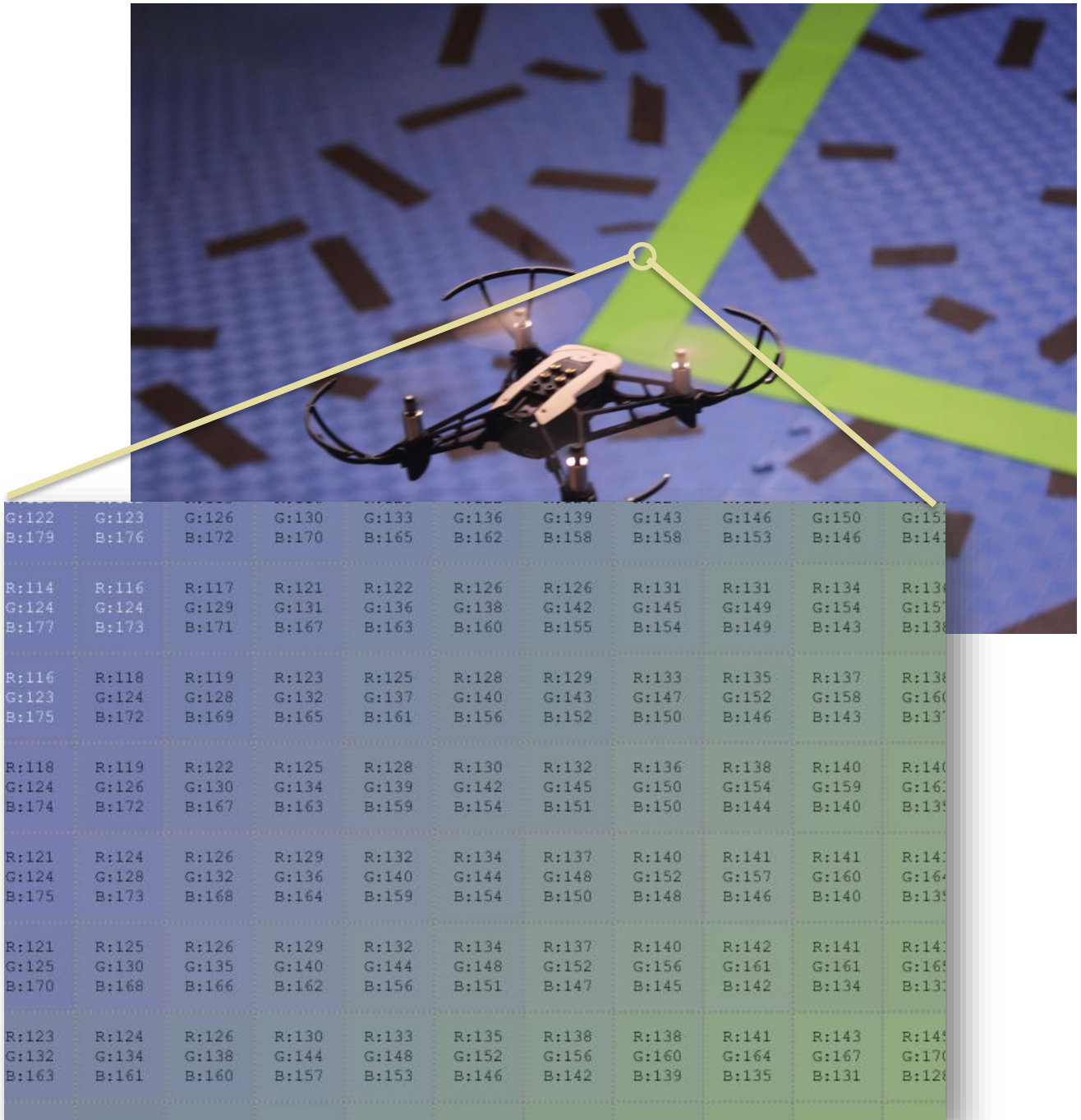


Simulation Camera View

What is an image?

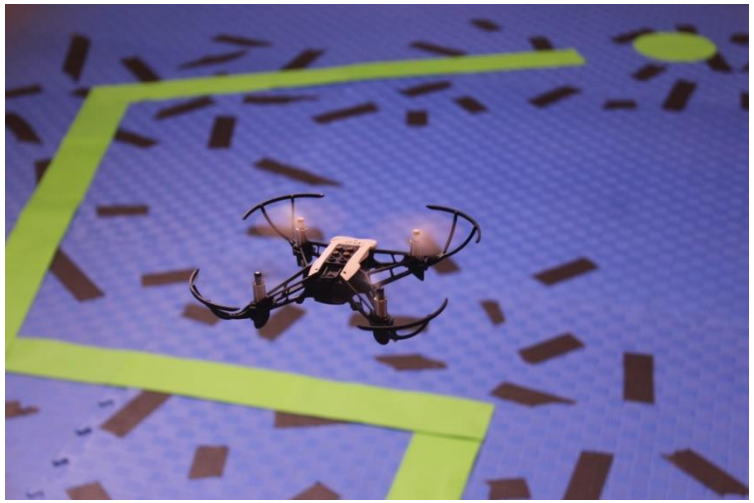
- Collection of pixels
  - Typically, a pixel has a value between 0 to 255
- Concatenation of channels in third dimension





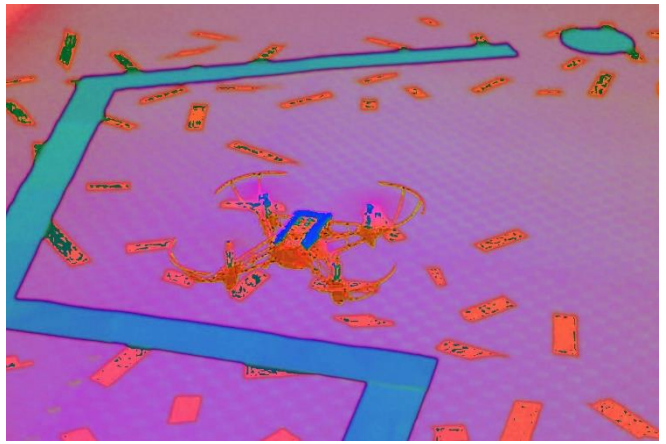
Color Spaces

RGB

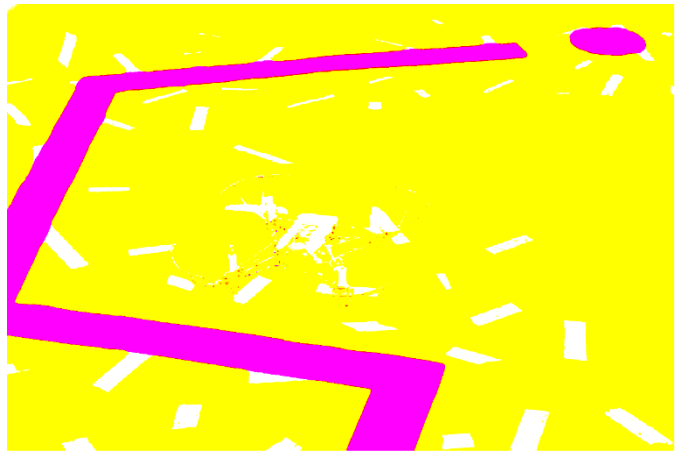


YCbCr

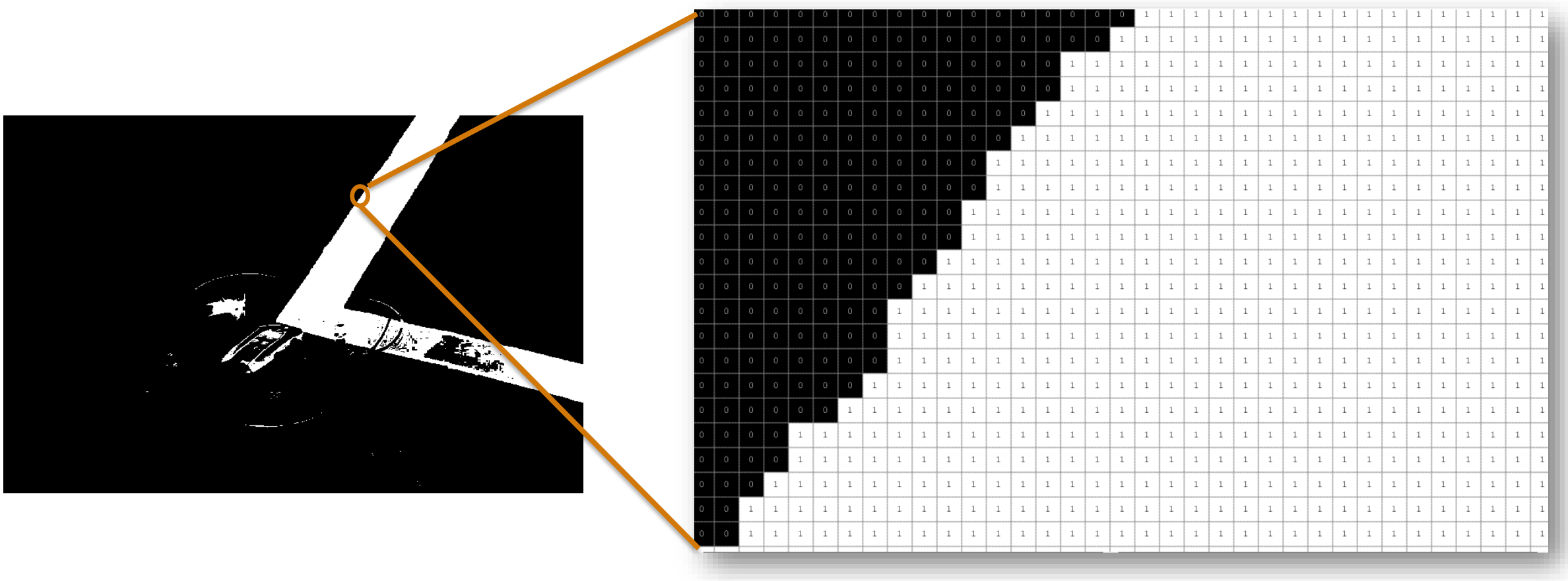
HSV



L*a*b*



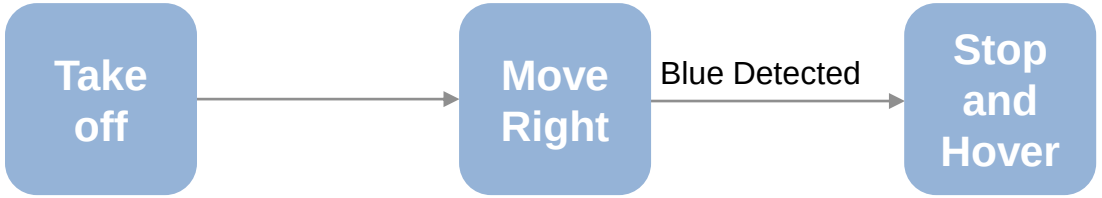
Binary Image



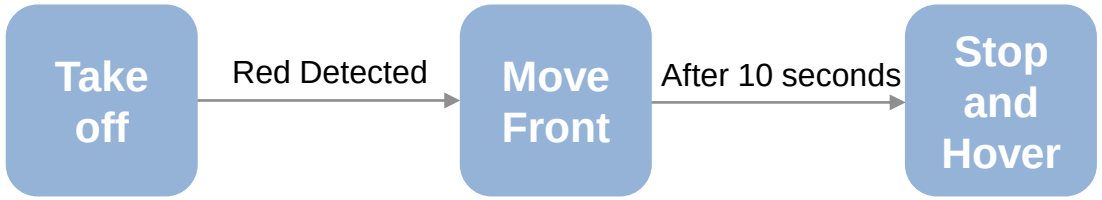
[*parrotMinidroneCompetition*: Image Processing System]

Tracking the first line segment
Task Difference

What we presently do?



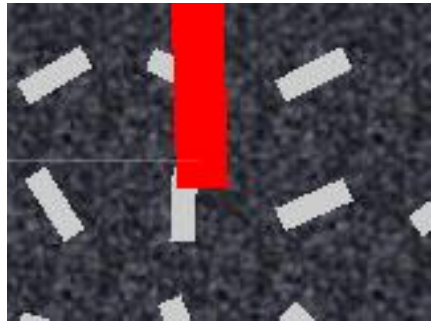
What we want to do?



Note: We are tracking only the first line segment for 10 seconds.

[Color Thresholder Example]
[Optional Hands-on]

Real World Camera View

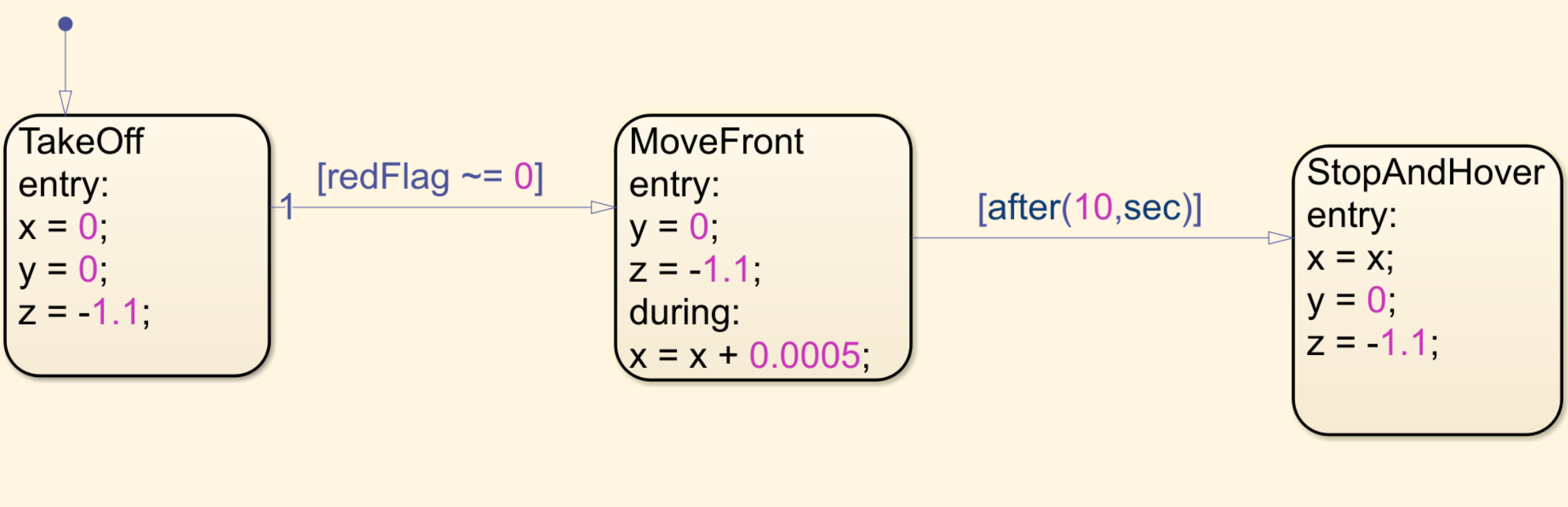


Simulation Camera View

[*parrotMinidroneCompetition*]

Tracking the first line segment

Stateflow



How can we make this algorithm better to follow the entire track?
What are the loopholes in this algorithm?
[Please post in the chat]

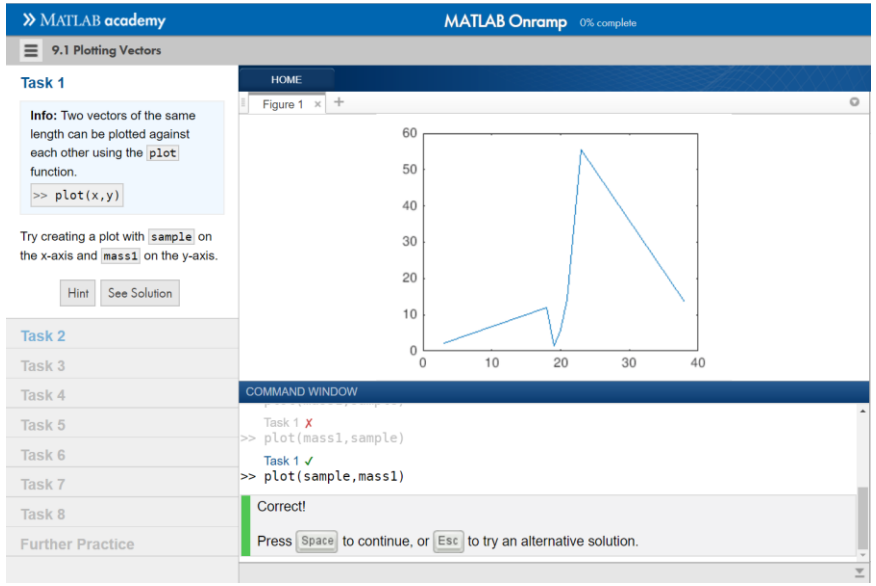

Control
Perceive
What did we learn through the series?
Implement
Plan

Learn MATLAB and Simulink

Self-Paced Onramp Courses

Learn basics with free 2-hour modules

- MATLAB
- Simulink
- Stateflow



Student Competition Tutorials:

Access videos and exercises on

- Mobile robotics basics
- Computer vision
- Code generation

Student Competition - Mobile Robotics Training

version 1.1.0.0 (13.8 MB) by MathWorks Student Competitions Team

All files related to Student Competition - Mobile Robotics Training video series.

Fun Exercise!

- Task:
  - Complete the red track and land on the circle

- Let us know what you have done:
  - Post a video/photo of your demo on social media (Instagram / Facebook / LinkedIn / Twitter) with

    #simulink #droneseries @MATLAB @MathWorks

- MathWorks Minidrone Competition which is a way for students to learn Model-Based Design

How to access the Onramps/Tools to try hands-on?

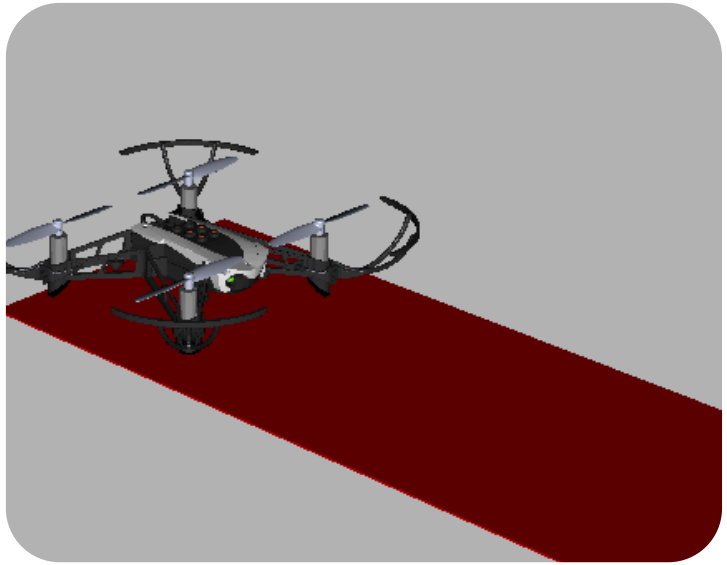
- Check if your institute has Campus Wide License:
  - https://www.mathworks.com/academia/tah-support-program/eligibility.html

- E-mail us at minidronecompetition@mathworks.com for access to license to work with exercise
  - First Name:
  - Last Name:
  - Institute/University:

MathWorks Minidrone Competition

Round 1: Simulation Round:

Design algorithms using Simulink



Round 2: Deployment Round:

Deploy on hardware using Simulink Support Package

MathWorks Minidrone Masters

IROS 2019

5 November 2019: The Venetian Macao, Macau, China

Winner: *SRMUAV*, SRM Institute of Science and Technology

First runner-up: *Beeclust*, SRM Institute of Science and Technology

Second runner-up: *KNUT_ROVI*, Korea National University of Transportation

NUMA 2019

18 October 2019: NUMA Bengaluru, Bengaluru, India

Winner: *HiveX*, B.M.S. College of Engineering

First runner-up: *PVGCOET*, Pune Vidyarthi Griha's College of Engineering

Second runner-up: *Madg(w)eek*, SRM Institute of Science and Technology

Resources

Robotics Arena

- **Contact us**

   minidronecompetition@mathworks.com

   facebook.com/groups/RoboticsArena/

- **Student Videos and Tutorials**
  mathworks.com/academia/student-competitions/tutorials-videos.html
- **Software offer**
  mathworks.com/academia/student-competitions
- **Racing Lounge blog:**
  blogs.mathworks.com/racing-lounge

- Post a video/photo of your demo on social media:
  - Instagram / Facebook / LinkedIn / Twitter with #simulink **#droneseries**

- Fill out the feedback form:
  bit.ly/minidrone-webinar-series

- Reach out to us to host/participate at minidronecompetition@mathworks.com

MATLAB and Simulink Robotics Arena

bit.ly/minidrone-webinar-series