

— WEBINAR —

Get ready to teach **ROBOTICS** remotely in Fall 2020

RICARDO TÉLLEZ

LIVE • Aug 06, 2020 at 7pm CEST



The
Construct

For ROS Developers

WWW.THECONSTRUCT.AI

Who is this webinar for

- * Professors/Teachers/Teacher assistants of undergrads/graduate students of robotics**
- * You need to prepare robotics course for FALL 2020**
- * You are searching for remote robotics teaching solution due to COVID-19**

What do I mean by teaching robotics?

- * Robot action and perception**

- * Arm Kinematics**

- * Mobile Robots Kinematics**

- * Robot Dynamics**

- * Motion Planning and Control**

- * Robot Navigation**

- * Computer Vision**

- * ROS**

I do not mean



I do mean



ROS and Robot Navigation Teacher at La Salle Univ. Barcelona

**Ricardo
Tellez, PhD**



WHAT WE WILL LEARN

For teaching robotics remotely you need

*** Teach the theory**

*** Provide some practice**

*** Provide off-hours support**

*** Evaluate students**

*** Hands-on: Connect to the real robot**

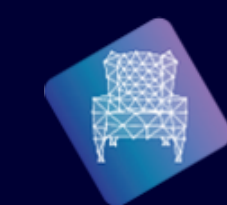
Stay with me to do a live demo of remote real robots



Get Ready to Teach Robotics Remotely in the Fall of 2020

Teaching the theory

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For teaching theory **remotely** you need

- * **Your teaching material (slides)**

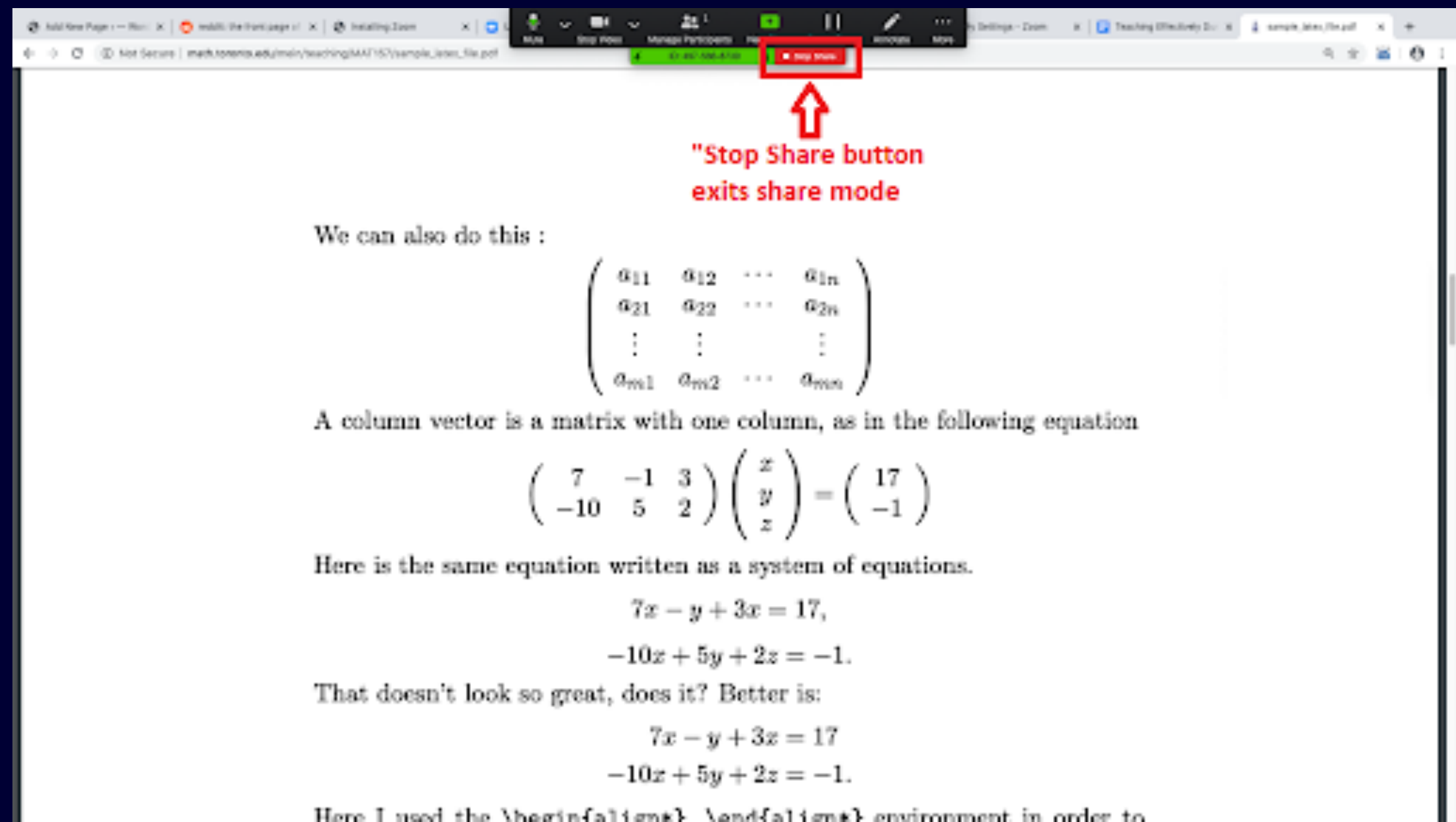
- * **A platform to deliver and communicate with students in real time**

 - * **Must allow:**

 - * **Sharing Screen (teacher & student)**

 - * **Live Chat (mic & written)**

Example: Zoom



↑
"Stop Share button
exits share mode"

We can also do this :

$$\begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}$$

A column vector is a matrix with one column, as in the following equation

$$\begin{pmatrix} 7 & -1 & 3 \\ -10 & 5 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 17 \\ -1 \end{pmatrix}$$

Here is the same equation written as a system of equations.

$$\begin{aligned} 7x - y + 3z &= 17, \\ -10x + 5y + 2z &= -1. \end{aligned}$$

That doesn't look so great, does it? Better is:

$$\begin{aligned} 7x - y + 3z &= 17 \\ -10x + 5y + 2z &= -1. \end{aligned}$$

Here I used the $\begin{aligned} & \end{aligned}$ environment in order to



Zoom Meeting ID: [redacted]

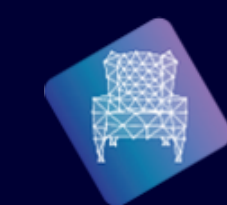
Participants: Josh Witty, Elizabeth Swan, Lynna Hu, John Mensik, Jeff Bechtel, Rob Rinsky, Mitchel Mayes, Angeline Huynh, Tamara Pitts, Zhenghang Gu, Shari Clare, Winston Twu, James Desmond - Denve..., Rozette Pasahol, Huey Le - Zoom CSM, Jenny Eggimann, Subriah Esharc, Heather Jarrett, Justin Henry, Matt Caballero, George Bassil, Kerushan Bisetty, John Poje, Brian McIntyre, Farah Faracias.

<https://youtu.be/JIRf1UH8ENw>

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Providing Practice

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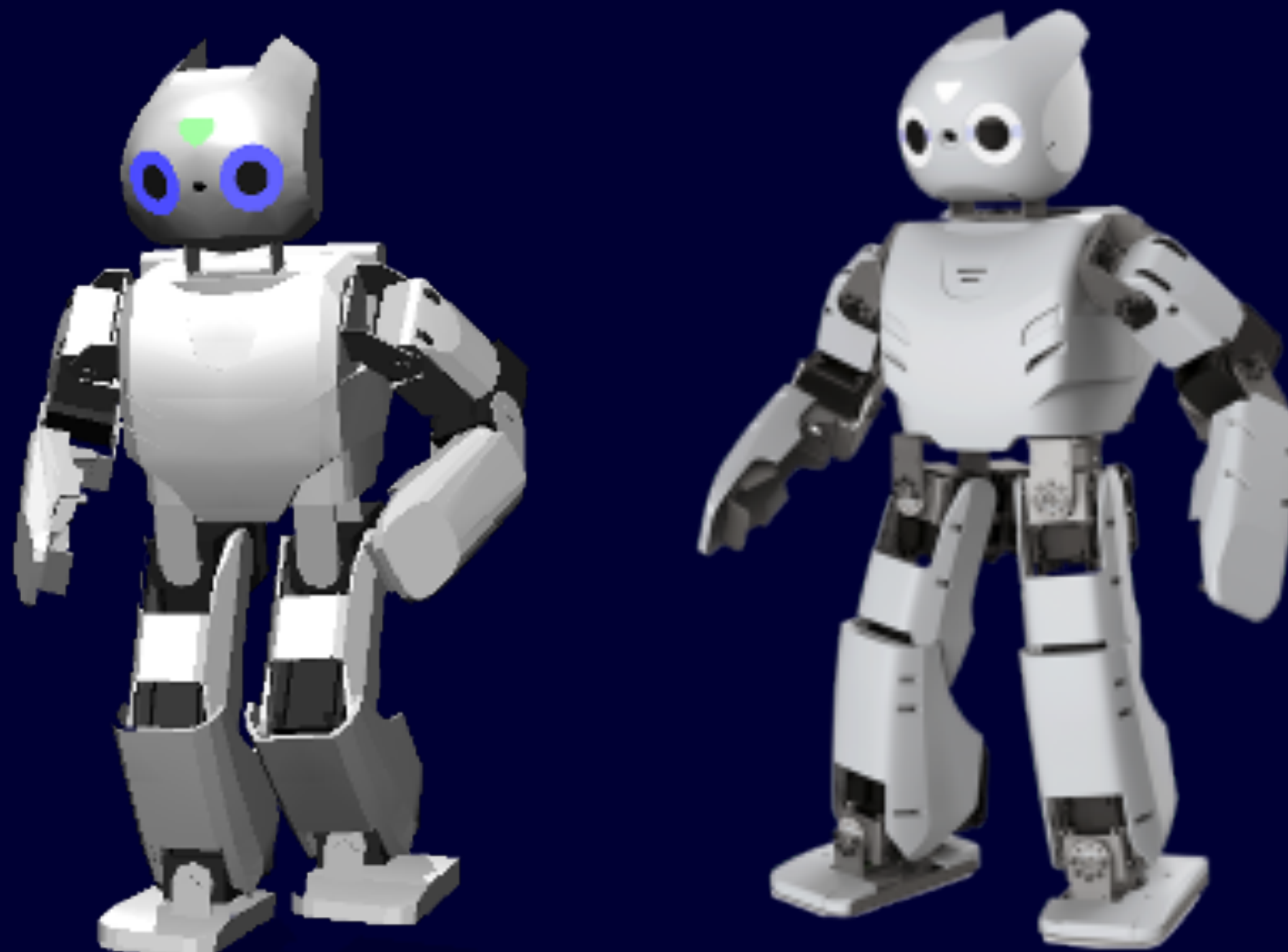
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Two ways to provide practice

- * **With simulated robots**

- * **With real robots**



Simulated robots: use ROS + Gazebo

* Install ROS on students' computer

<http://wiki.ros.org/ROS/Installation>

ROS Installation Options

There is more than one ROS distribution supported at a time. Some are older releases with long term support, making them more stable, while others are newer with shorter support life times, but with binaries for more recent platforms and more recent versions of the ROS packages that make them up. See the [Distributions](#) page for more details. We recommend one of the versions below:

ROS Kinetic Kame

Released May, 2016

LTS, supported until April, 2021

This version isn't recommended for new installs.



ROS Melodic Morenia

Released May, 2018

LTS, supported until May, 2023

Recommended for Ubuntu 18.04



ROS Noetic Ninjemys

Released May, 2020

Latest LTS, supported until May, 2025

Recommended for Ubuntu 20.04



Simulated robots: use ROS + Gazebo

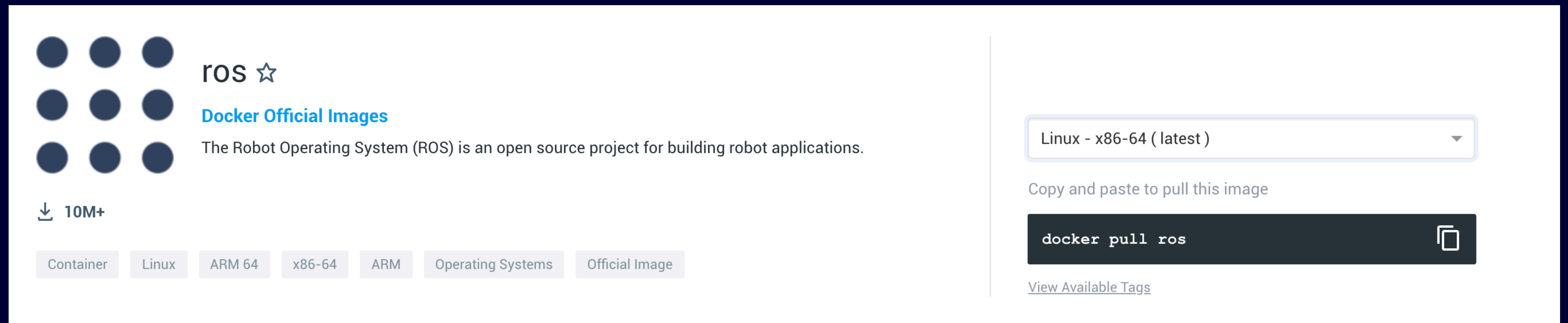
*** Provide a Virtual Machine with ROS**

https://youtu.be/59F6Jake_48

Simulated robots: use ROS + Gazebo

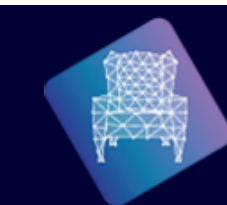
*** Provide a docker with ROS**

https://hub.docker.com/_/ros/



The screenshot shows the Docker Hub interface for the ROS official image. On the left, there's a grid of nine dark blue circles representing the ROS logo. To the right of the logo, the text "ROS ☆" is displayed, followed by "Docker Official Images" in blue. Below this, a description states: "The Robot Operating System (ROS) is an open source project for building robot applications." A download icon and "10M+" are shown below the description. A row of tags includes "Container", "Linux", "ARM 64", "x86-64", "ARM", "Operating Systems", and "Official Image". On the right side, a dropdown menu shows "Linux - x86-64 (latest)". Below the dropdown, the text "Copy and paste to pull this image" is followed by a dark button with the command "docker pull ros" and a copy icon. At the bottom right, there's a link "View Available Tags".

ROS ☆
Docker Official Images
The Robot Operating System (ROS) is an open source project for building robot applications.
↓ 10M+
Container Linux ARM 64 x86-64 ARM Operating Systems Official Image
Linux - x86-64 (latest)
Copy and paste to pull this image
docker pull ros
View Available Tags



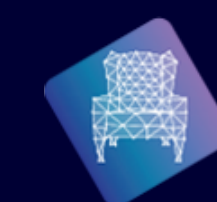
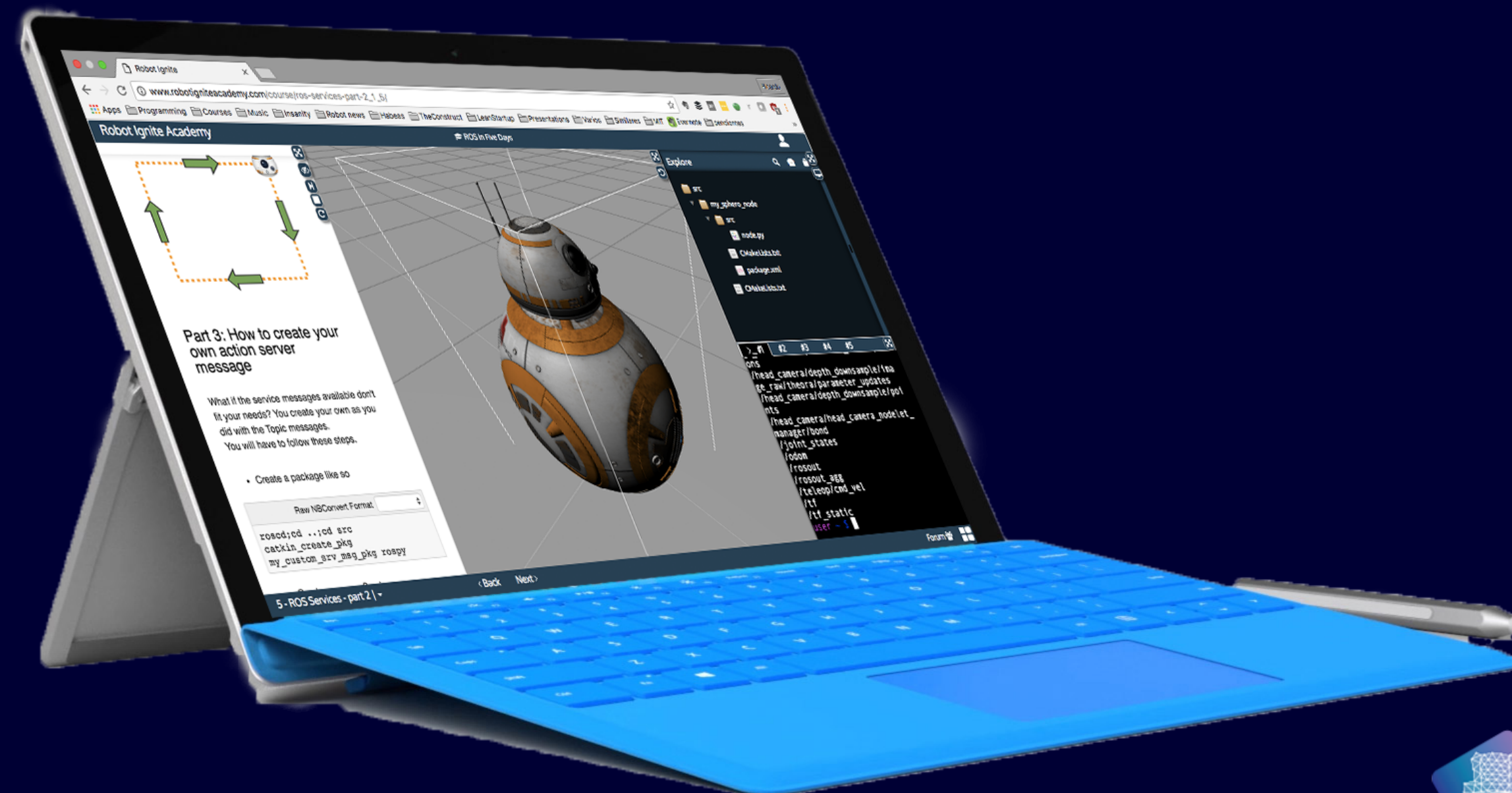
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Simulated robots: use ROS + Gazebo

*** Use a web based environment**

<http://robotignite.academy>



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Simulated robots: use ROS + Gazebo

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Book a demo meeting here

<https://bit.ly/2XxPox5>

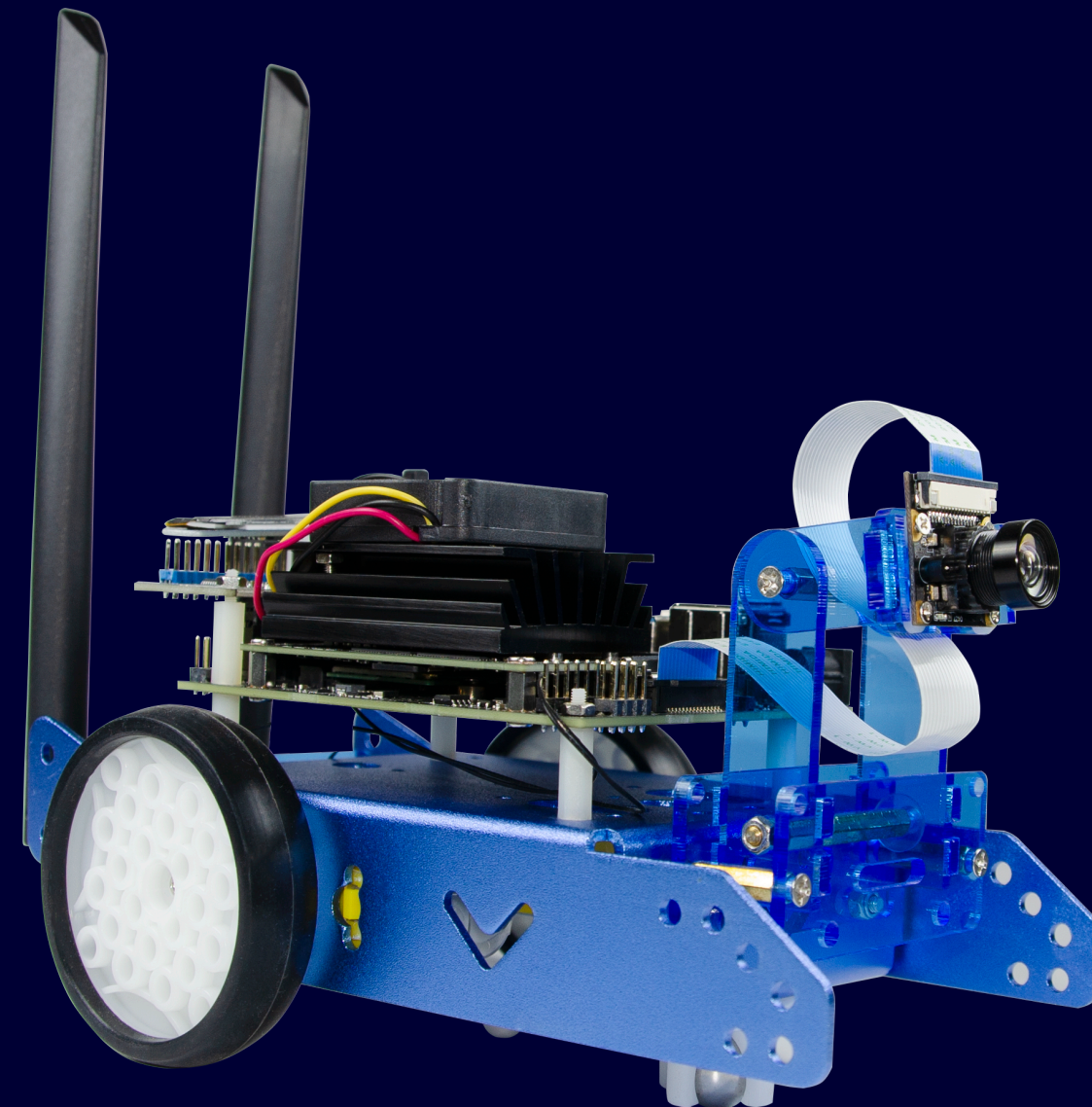


Real robots: use ROS based robots

*** Provide real robot to each student (around 200\$)**

Base system (110\$) : <https://amzn.to/2DBpDov>

Additions for Jetbot (110\$): <https://amzn.to/2XwJT1G>



Real robots: use ROS based robots

*** Provide remote robot lab**



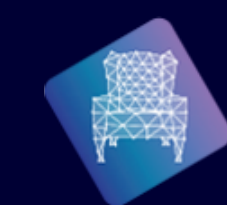
Real robots: use ROS based robots

* Provide remote robot lab

1. Have a robot with internet access
2. Install a server in the robot
3. Add external camera
4. Connect to it from ROSDS

HOW TO SETUP:

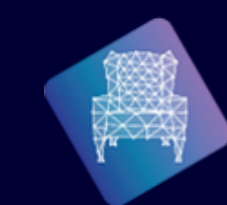
<https://youtu.be/fzogfWRamDI>



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Off-hours Support

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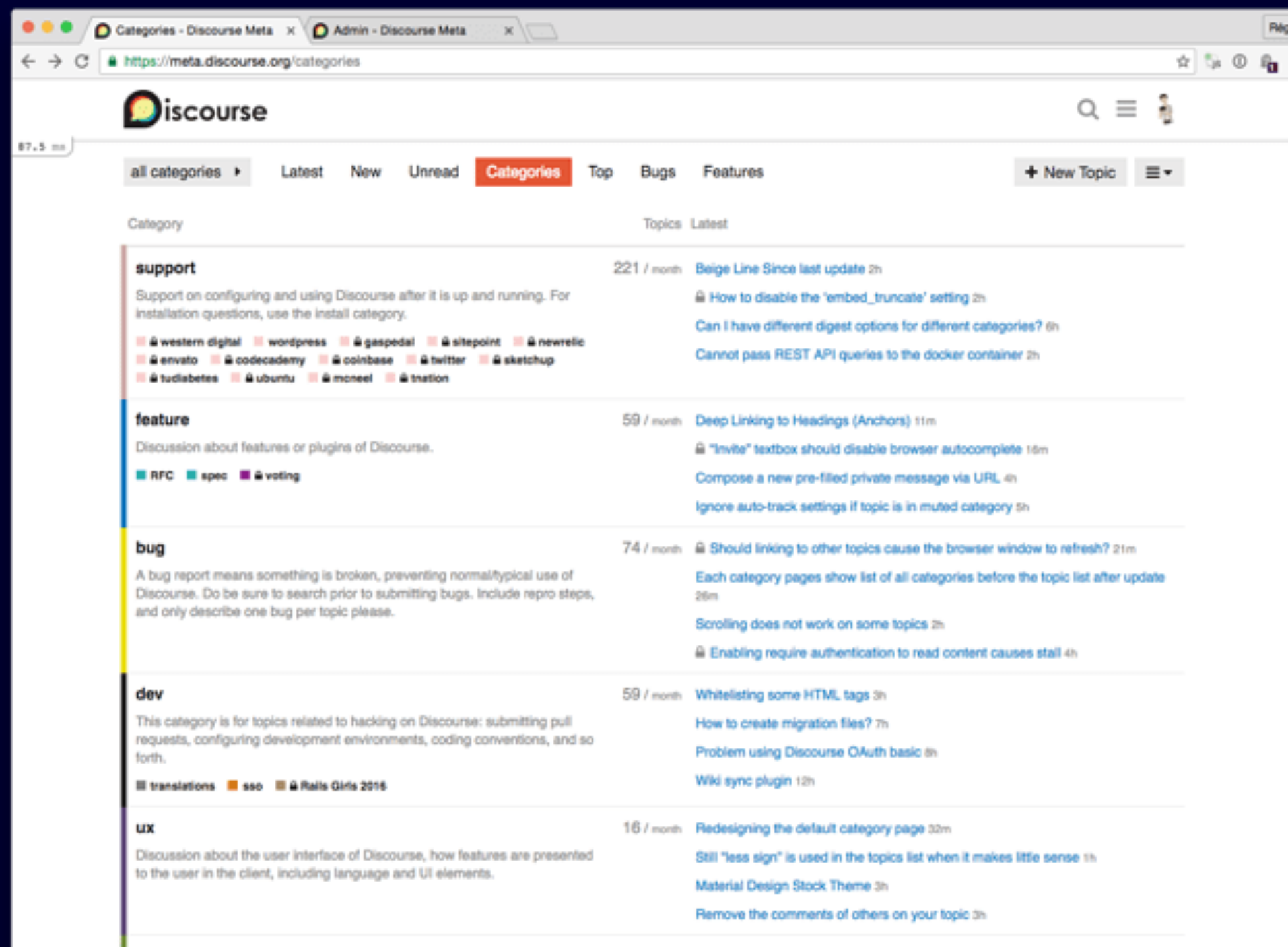
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Provide a Forum for Q&A

* Use the one provided by the University

* Or install a Discourse: <https://bit.ly/2C7vuS2>



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Evaluation of students

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Exams based on doing ROS code

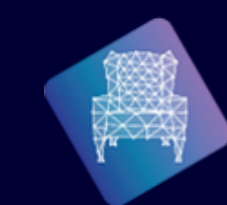
- * They must apply their knowledge

- * Easy to detect when they copy

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Conclusions

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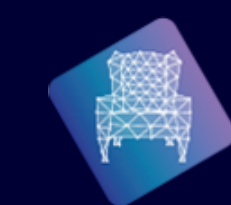


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Start getting ready!

*** We are going to need to do that for the next semesters**



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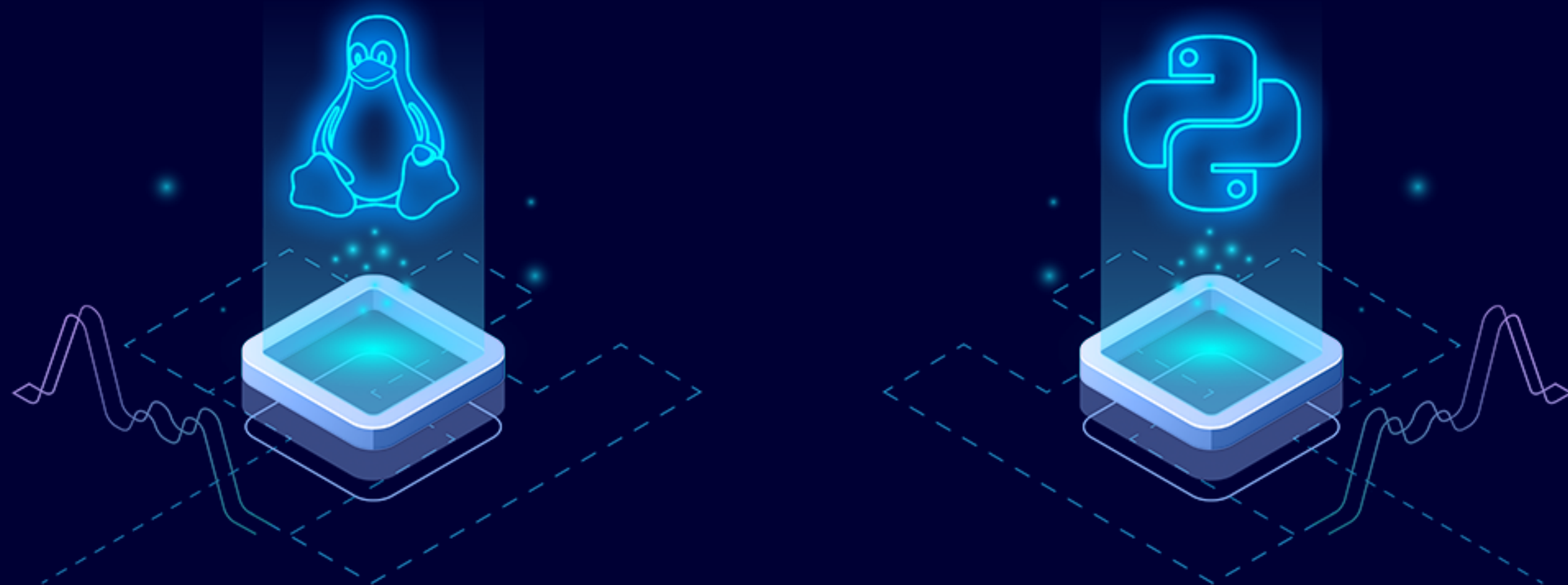
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Start getting ready!

*** Free Online Courses to start:**

1. Linux for Robotics: <https://bit.ly/2PACycJ>

2. Python for Robotics: <https://bit.ly/3gzPKdR>



Start getting ready!

robotignite
ACADEMY

roscd <package_name>

It will take you to the path where the package *package_name* is located.

Example 2.2

Go to WebShell #1, navigate to the turtlebot_teleop package, and check that it has that structure.

Execute in WebShell #1

In []:

roscd turtlebot_teleop

ls

user:~\$ roscd turtlebot_teleop/

user:/home/simulations/public_sim_ws/src/all/turtlebot/turtlebot_teleop\$ ls

CHANGELOG.rst CMakeLists.txt launch package.xml param README.md src

Every ROS program that you want to execute is organized in a package.

Every ROS program that you create will have to be organized in a package.

Packages are the main organization system of ROS programs.

END Example 2.2

And... what's a launch file?

We've seen that ROS uses launch files in order to execute programs. But... how do they work? Let's have a look.

Example 2.3

ROS BASICS IN 5 DAYS

File Edit Selection View Go Debug Terminal Help

EXPLORER: US...

catkin_ws

build

devel

src

logger_example_pkg

my_package

launch

src

simple_topic_publ...

simple.py

test.py

CMakeLists.txt

package.xml

simple_service_pkg

laser.bag

simple.py

15

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ros.py.init_node('que_bien_ques_viernes')

pub = rospy.Publisher('/cmd_vel', Twist, queue_size=1)

sub = rospy.Subscriber('/kobuki/laser/scan', LaserScan,

rate = rospy.Rate(10)

vel = Twist()

vel.linear.x = 0.3

while not rospy.is_shutdown():

if obst < 0.50:

vel.angular.z = 0.9

else:

vel.angular.z = 0.0

pub.publish(vel)

rate.sleep()

Ln 1, Col 1 LF UTF-8 Spaces: 4 Python

Terminal

>_ #1

>_ #2

>_ #3

>_ #4

/cmd_vel_mux/input/switch

/cmd_vel_mux/input/teleop

/cmd_vel_mux/parameter_descriptions

/cmd_vel_mux/parameter_updates

/gazebo/link_states

/gazebo/model_states

/gazebo/parameter_descriptions

/gazebo/parameter_updates

/gazebo/set_link_state

/gazebo/set_model_state

/joint_states

/kobuki/laser/scan

/mobile_base/command/velocity

/mobile_base/parameter_descriptions

/odom

/rosout

/rosout_agg

/tf

/tf_static

user:~\$

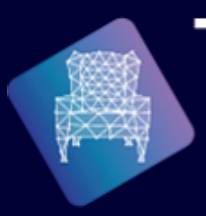
2 - ROS Basics

< Back Next >

GET HELP

Book a demo meeting here

<https://bit.ly/2XxPox5>

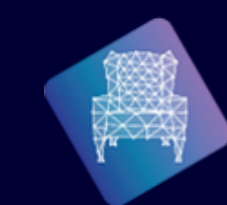
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Q&A

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