

2022 BEST Robotics
Spring
Autonomous Programming
Challenge

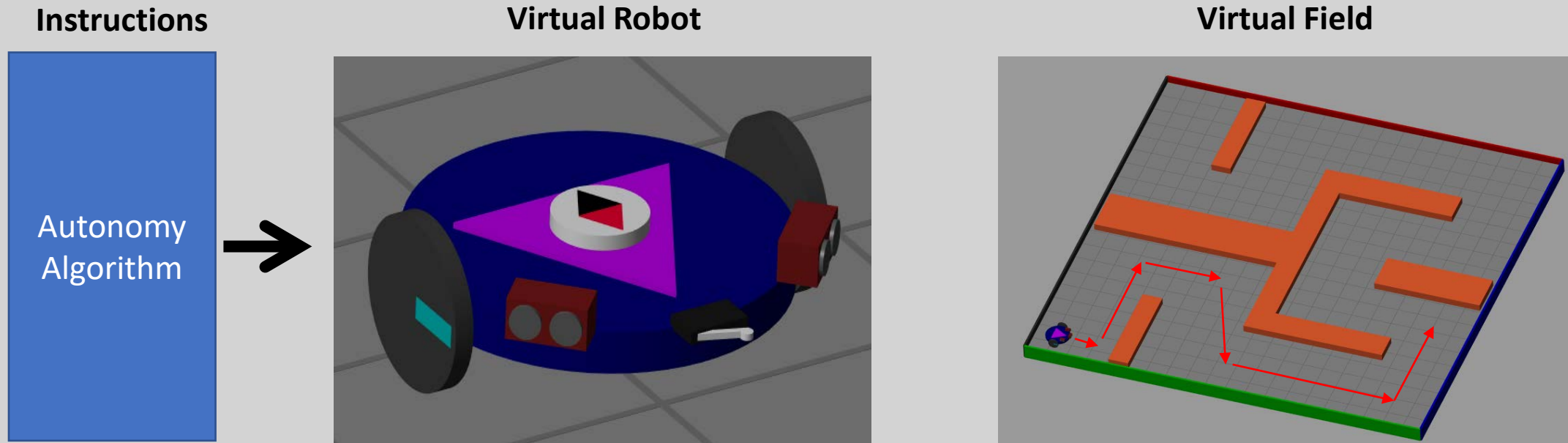
PREVIEW GUIDE



Autonomous Programming Skills Challenge

What is it?

- Create Autonomous programs to solve the game objectives
 - Responding, reacting and running independently, with no direct human control



Autonomous Programming Skills Challenge

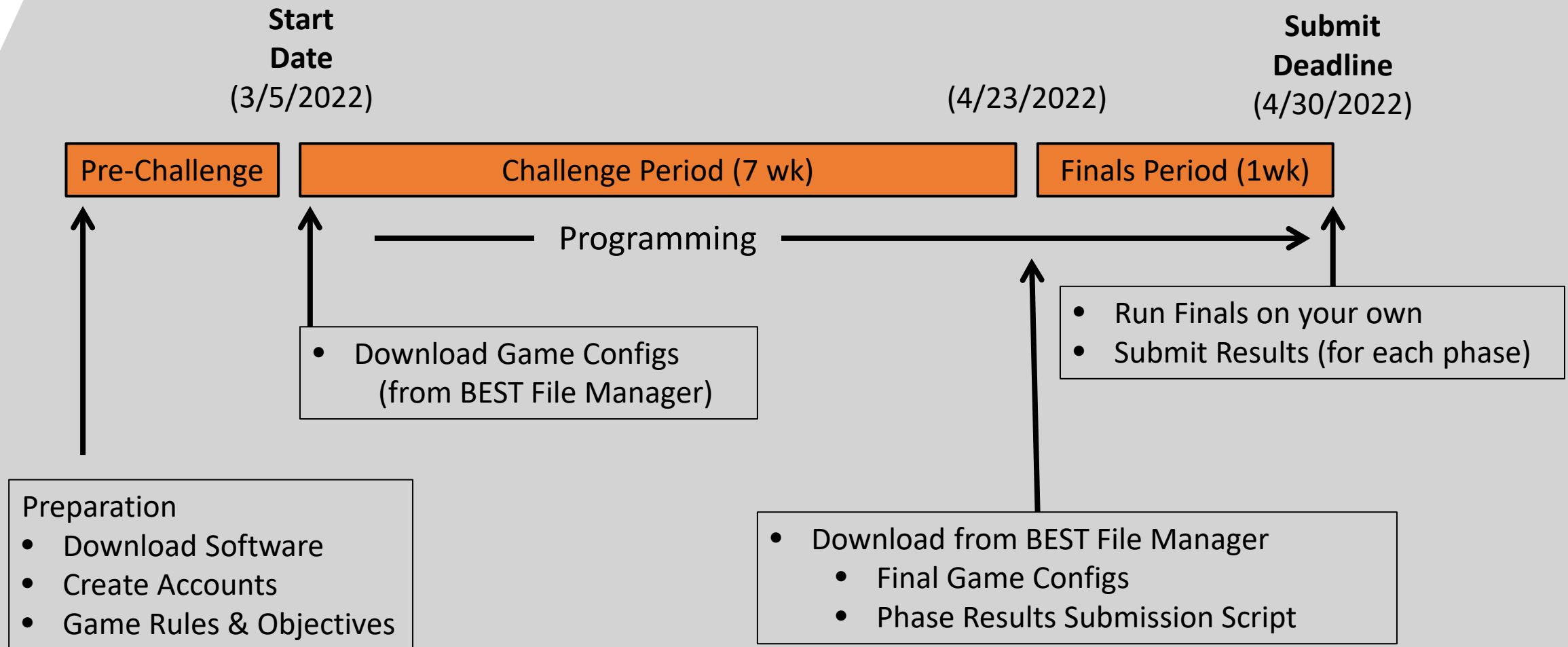
What is it?



- Uses Mathworks Robotics Playground
 - 3D Virtual Field and Virtual Robot provided
- Multiple Phases
 - Unique Objectives
 - Unique Time Constraints
- Multiple Levels of Ranking & Awards
 - Team Award (for 2021 BEST teams)
 - Individual Awards (for any participant)
- You can compete for team awards or individual awards
- Complete rules and instructions provided at the Kickoff, March 5th 2022

Autonomous Programming Challenge

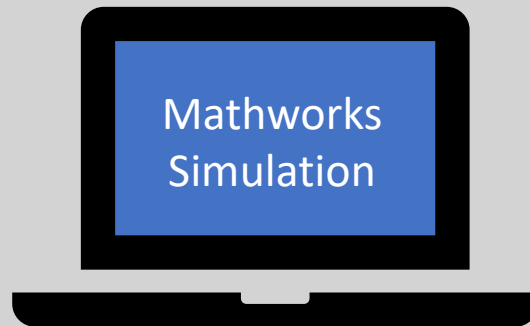
Challenge Protocol



Autonomous Programming Options

Local or Cloud Environments

OPTION 1



Student

Single Windows Computer
✓ meeting system requirements

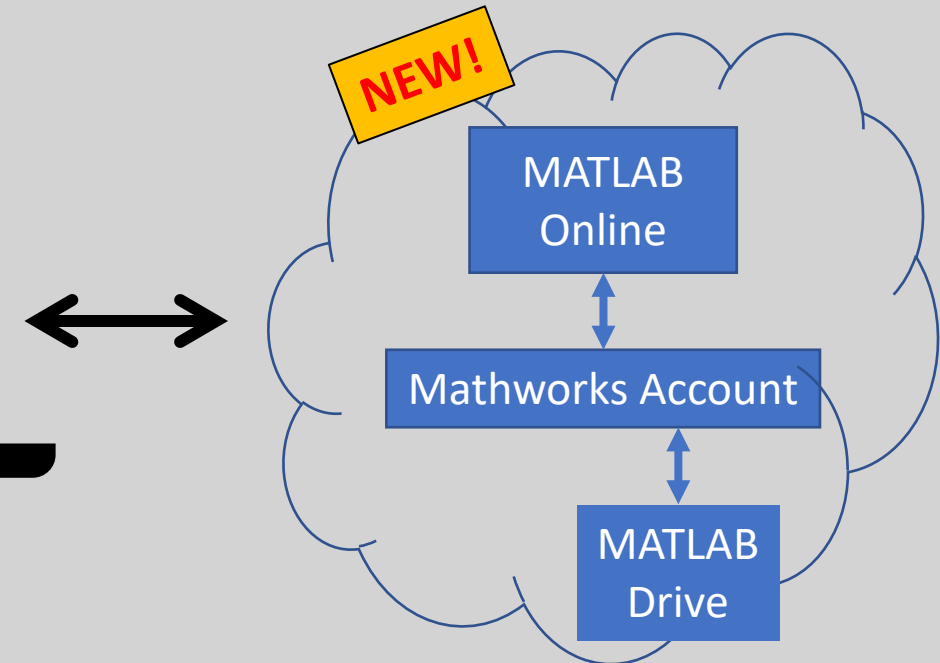
OR

OPTION 2



Student

Any Computer
✓ With Internet Access

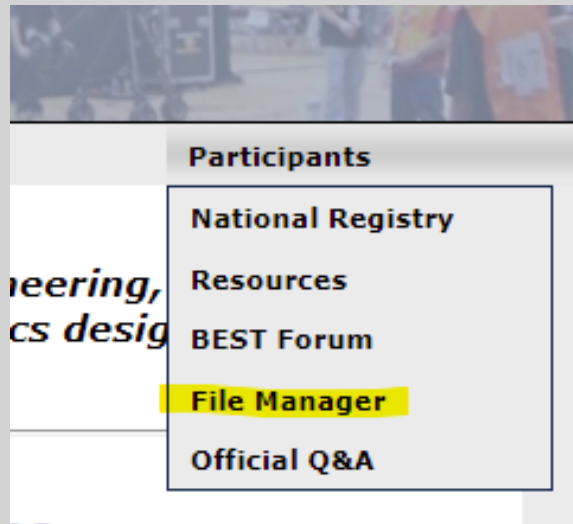


***3D Simulation is done in the cloud!
Access & run from any computer!***

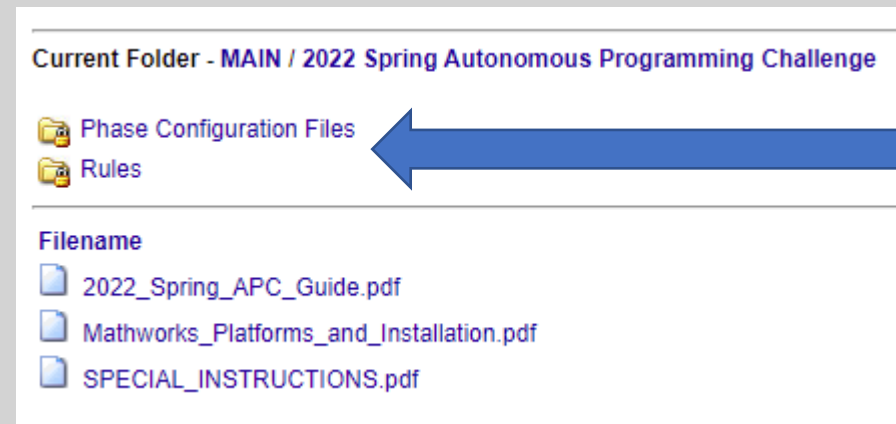
User Guides

Rules, Installation and Guides available through the BEST Robotics File Manager

<https://www.bestrobotics.org>



Navigate to the challenge folder



On Kickoff Day
(March 5, 2022)

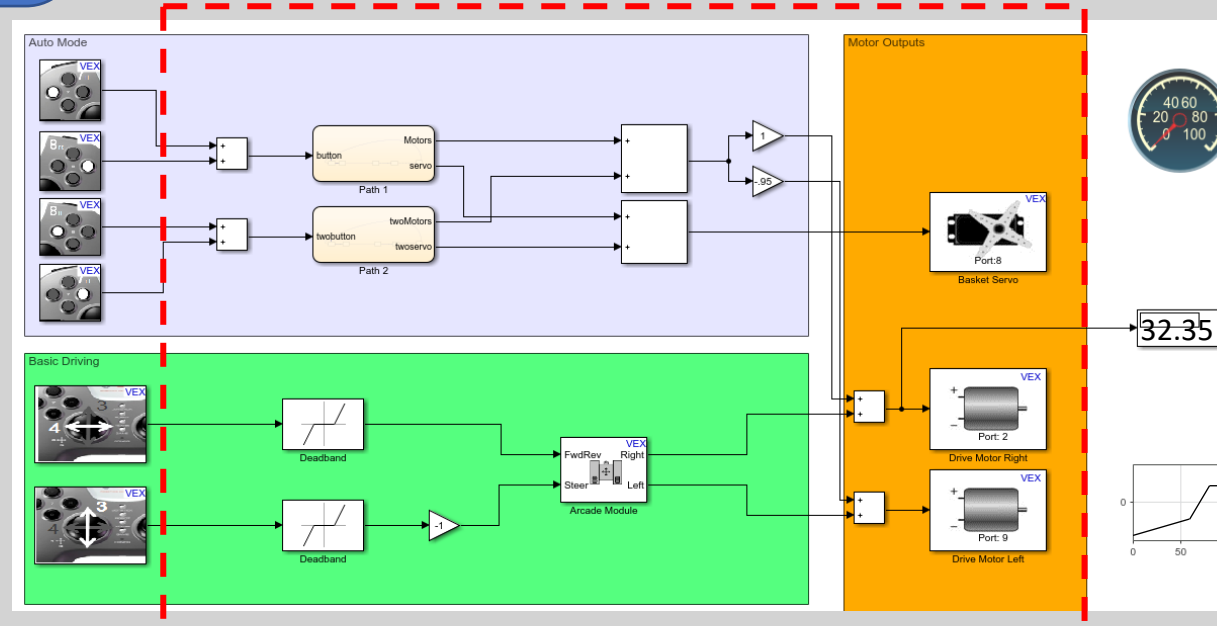
What is Simulation?

Modeling Robot Behavior



SIMULINK MODEL

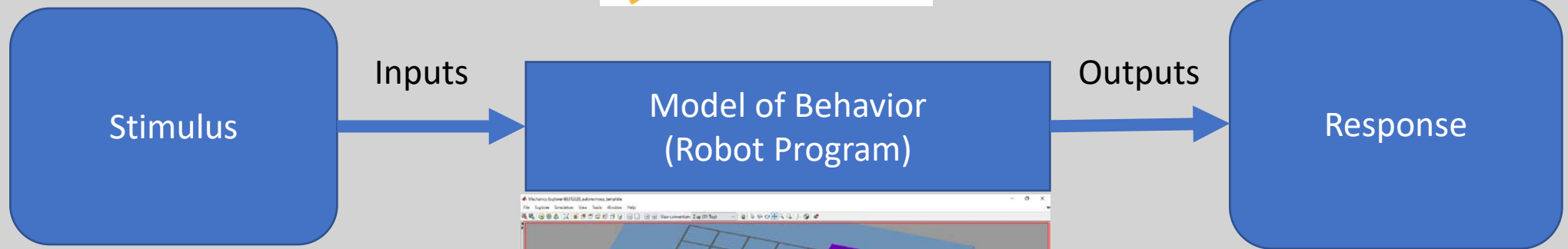
Constant,
Toggle,
Slider,
Algorithm



Displays,
Gauges,
Graphs,
Plots,
etc.

What is Simulation?

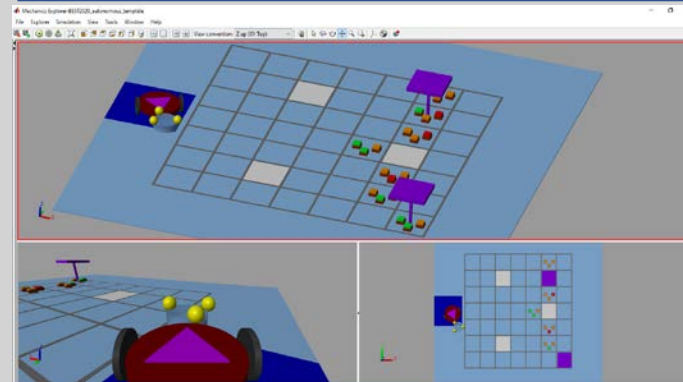
Modeling the Environment



SIMULINK

Constant, Toggle, Slider, etc.
Algorithm

Displays, Gauges, Plots, etc.



Model of Behavior Environment (i.e., Game Field)

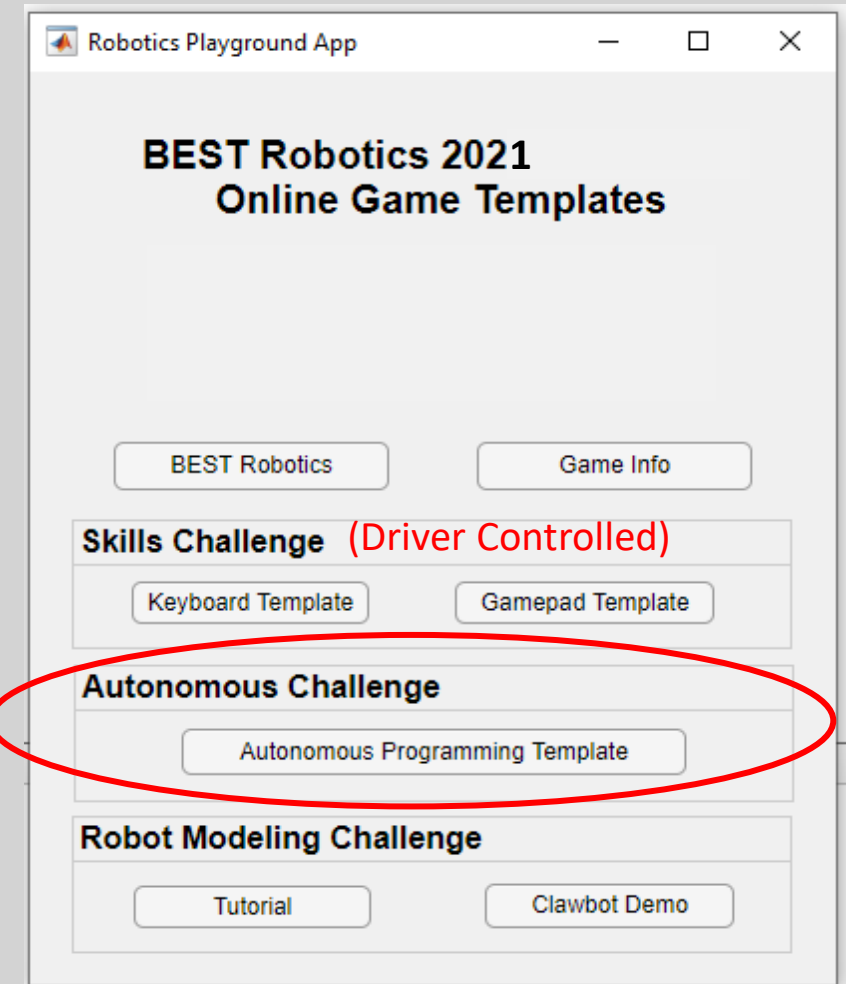
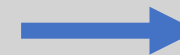
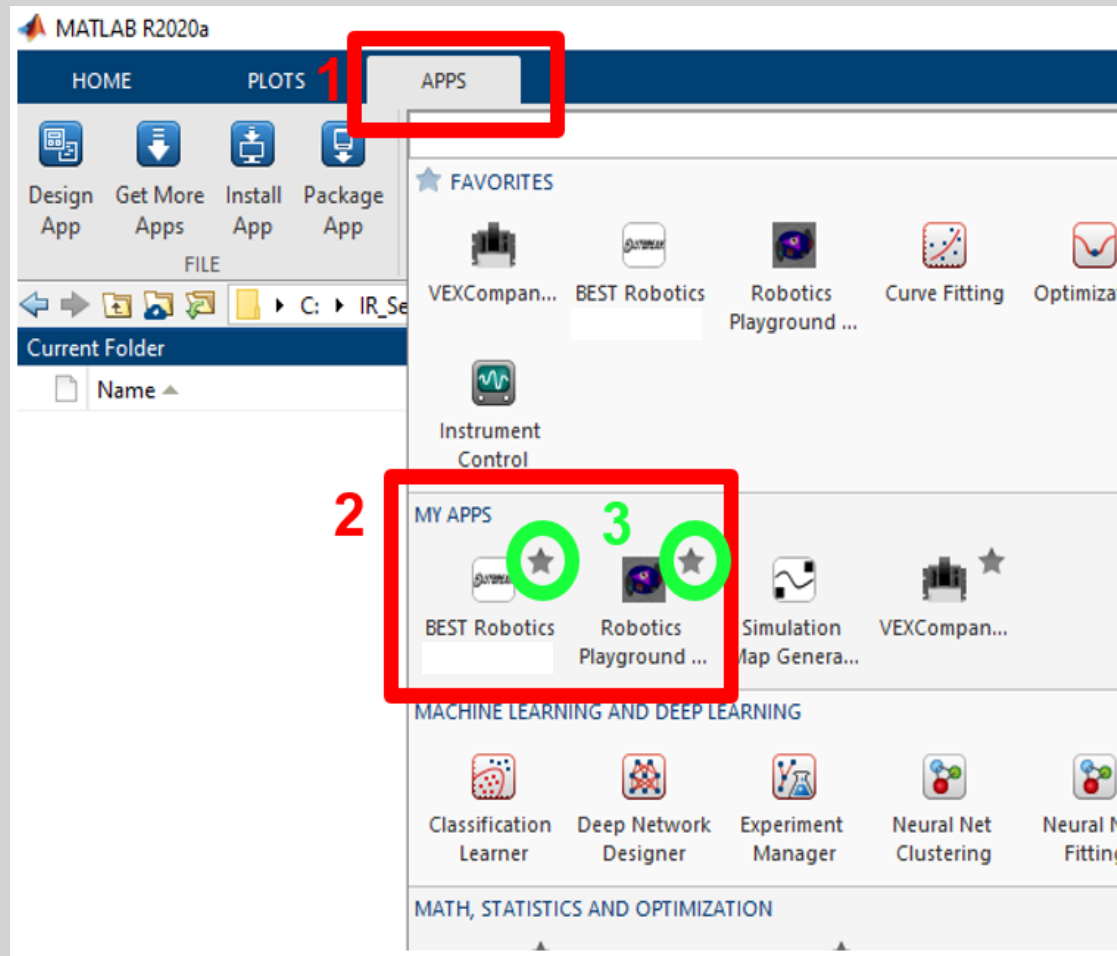
3D Graphical View of Solid Model

ROBOTICS PLAYGROUND

Joystick/ Keyboard,
Algorithm

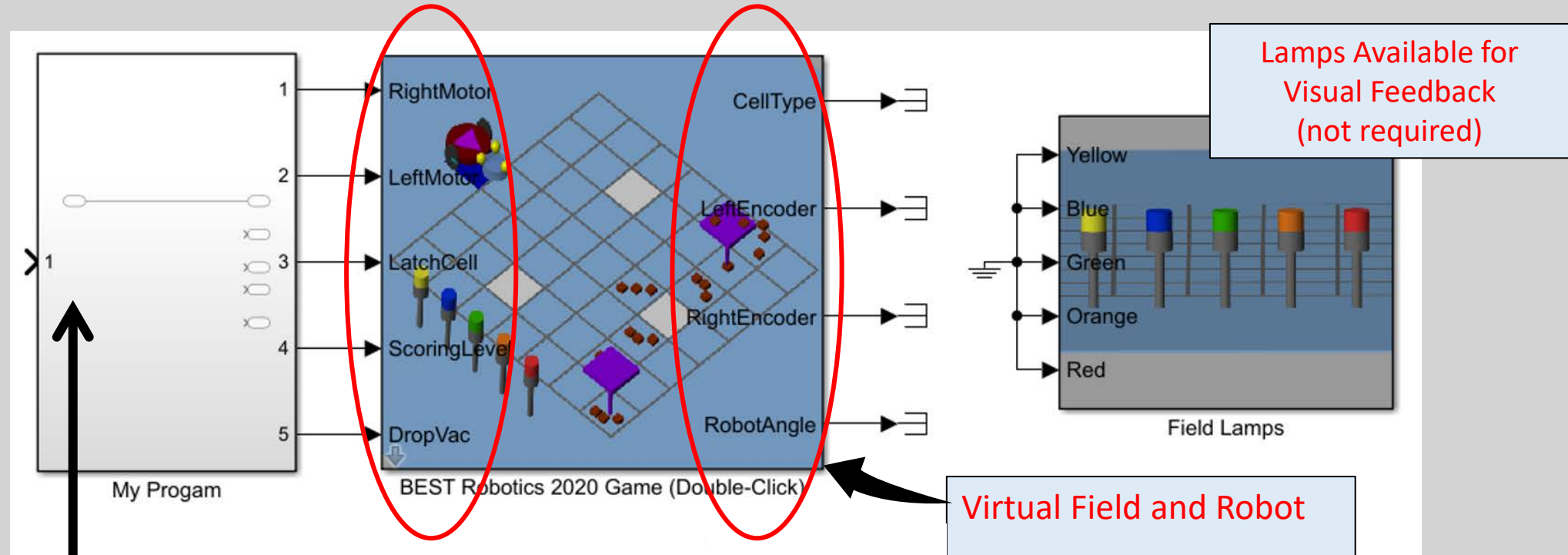
Getting Started

(BEST Robotics App and Simulink Model Templates)



Simulink Model Autonomous Template

Programming The Virtual Robot



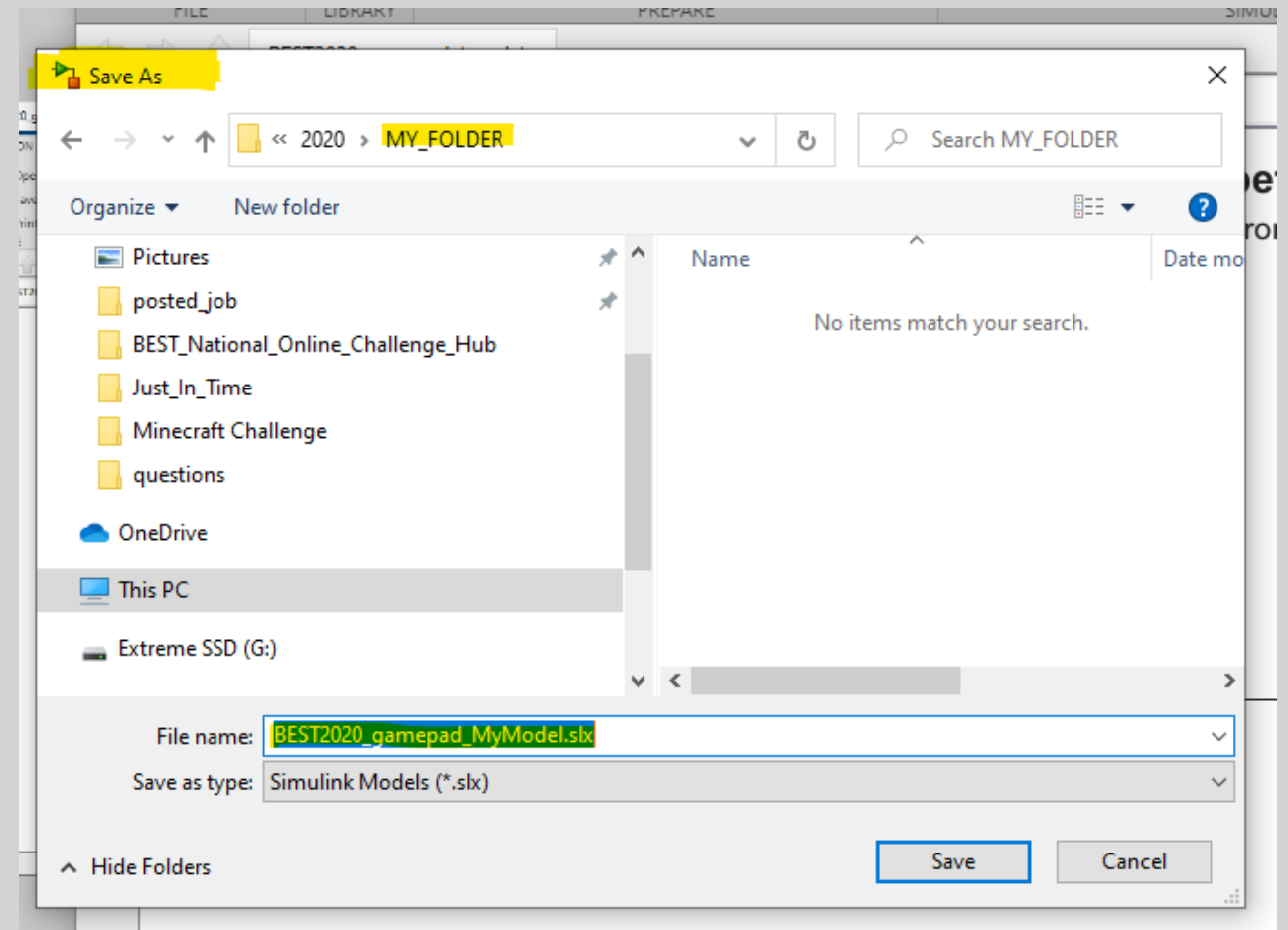
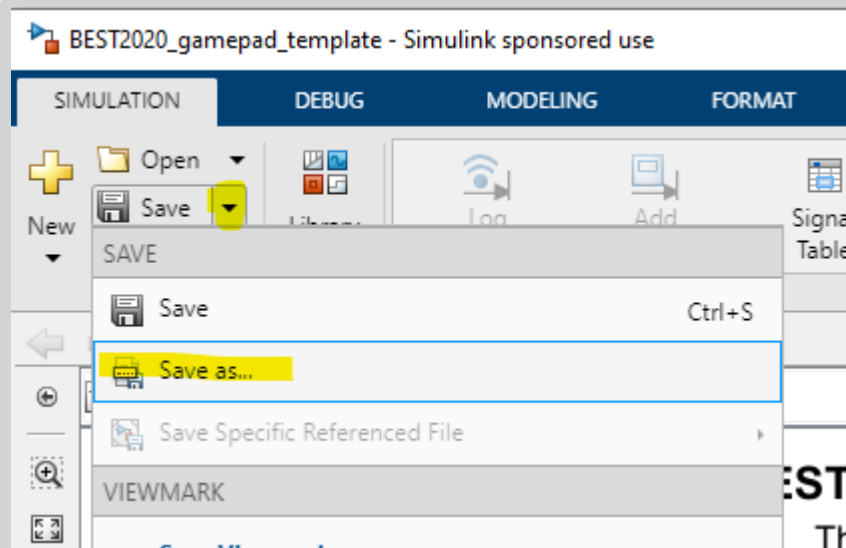
Your Autonomous Algorithm

Virtual Robot Inputs

Virtual Robot Outputs

Virtual Field and Robot
Do Not Change!
Add your programming outside of this block

Saving YOUR Simulink Model Programming






- Save your Simulink model in a NEW folder
- Do Not Overwrite the Template File!

Game Configurations

- Multiple Phases/Game Configs
- Each Phase has a Unique Objective
 - Collect Certain Items
 - Complete Specific Tasks
 - Specific Time Allowed (e.g., 30 sec, 1 minute, etc.)
- Initial Game Configs available at Kickoff
- Provided via the BEST File Manager
- ***Final Game Configs Available at beginning of Week 8 (April 23)***

Current Folder - MAIN / 2022 Spring Autonomous Programming Challenge / Phase Configuration Files

Filename	Date Uploaded
 BEST2021GameConfig1.m	2022-02-22
 BEST2021GameConfig2.m	2022-02-22
 BEST2021GameConfig3.m	2022-02-22
 BEST2021GameConfig4.m	2022-02-22
 BEST2021GameConfig5.m	2022-02-22
 BEST2021GameConfig6.m	2022-02-22
 BEST2021GameConfigFinals1.m	2022-02-22
 BEST2021GameConfigFinals2.m	2022-02-22
 BEST2021GameConfigFinals3.m	2022-02-22
 BEST2021GameConfigFinals4.m	2022-02-22
 BEST2021GameConfigFinals5.m	2022-02-22
 BEST2021GameConfigFinals6.m	2022-02-22
 MyMultipartFormProvider.m	2022-02-22
 SPECIAL_INSTRUCTIONS.pdf	2022-02-22
 uploadPhaseResults.m	2022-02-22

Selecting the Game Field Configuration

Double-click

Block Parameters: BEST Robotics 2021 Game (Double-Click)

RP BEST Robotics 2021 Challenge (mask)

This block contains a virtual game for the BEST Robotics 2021 competition. Please refer to the instructions provided by competition organizers for more information on game rules.

Inputs:
 Motor Voltages (Torque) [-127 to 127]
 LatchObject (Pickup Object) [0 or 1]
 RaiseObject (Floor or Dumpster) [0 or 1]
 DropPole (Release pole) [0 or 1] Array of 3
 Encoder Reset(normal operation or Reset) [0 or 1]

Outputs:
 Object Type (See Game Rules) [0 ,1 , 2 ,3, 4, 5, 6, 7 or 8]
 Sensors (See inside block for sensor properties and outputs)

For MATLAB and Simulink related questions please email:
 roboticsarena@mathworks.com

Game Settings Robot settings Tab

Game Time (s) 180

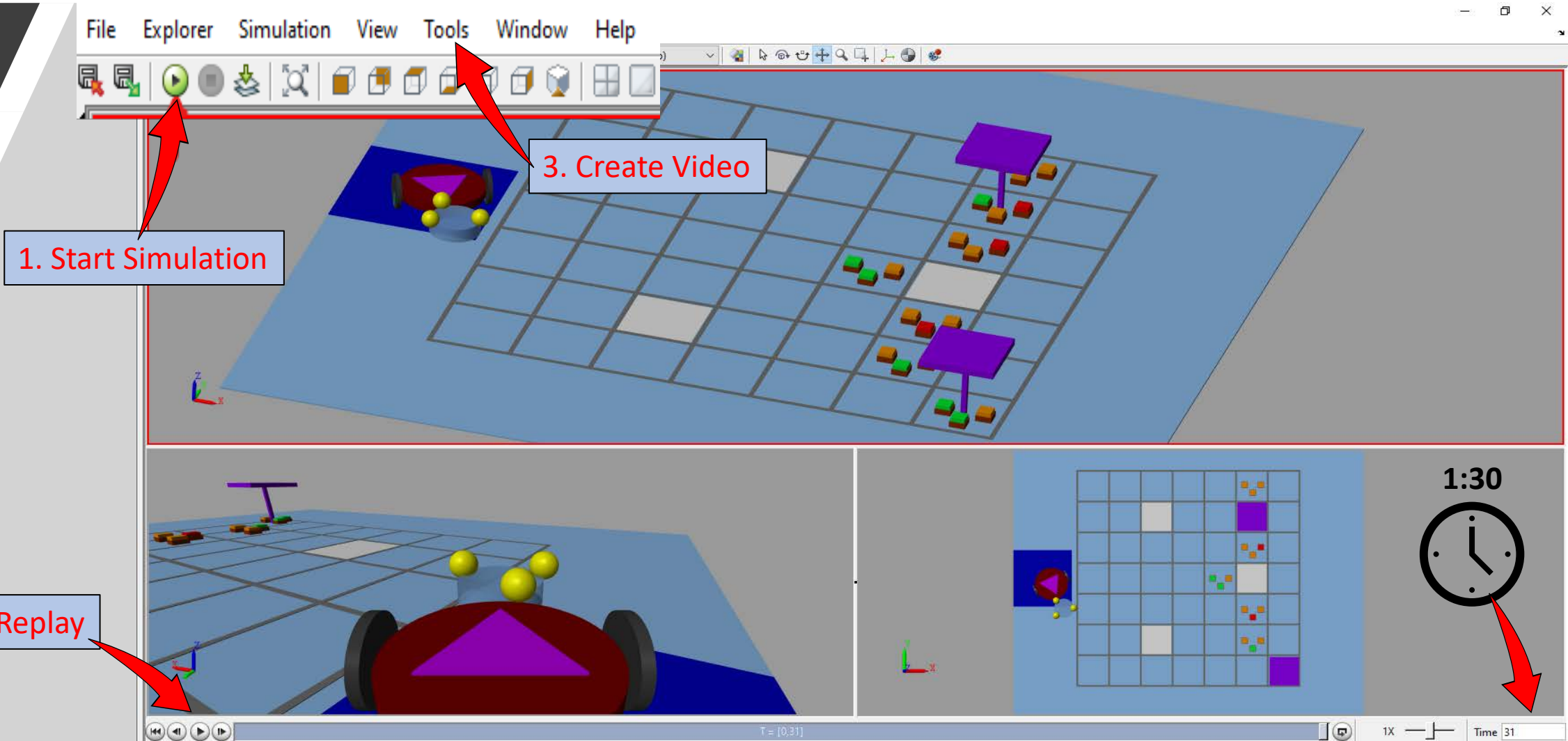
Field Layout: Phase 5 (Provided during competition)
 Practice 1
 Practice 2
 Practice 3
 Phase 1 (Provided during competition)
 Phase 2 (Provided during competition)
 Phase 3 (Provided during competition)
 Phase 4 (Provided during competition)
 Phase 5 (Provided during competition)
 Phase 6 (Provided during competition)

OK Cancel Help Apply

- Game Field Configuration Setup
 - Game Field Configuration Files
 - Select the Field Layout
 - Matching the Phase# (1-6)
 - Set the Allowed Game Time (seconds)

Running each Phase Time Trial

Running Simulation, Creating Video



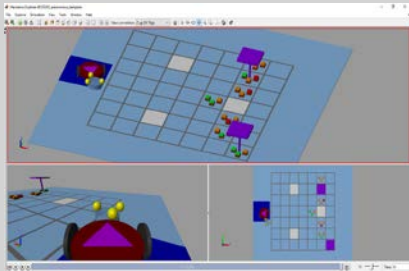
The screenshot shows a software window with a menu bar (File, Explorer, Simulation, View, Tools, Window, Help) and a toolbar. The main area displays a 3D simulation of a robot on a grid. Three red callout boxes with arrows point to specific features:

- 1. Start Simulation:** Points to the green play button in the toolbar.
- 2. Replay:** Points to the left-pointing arrow in the playback controls at the bottom.
- 3. Create Video:** Points to the video camera icon in the toolbar.

At the bottom right, a clock icon shows a time of 1:30, with a red arrow pointing to it. The bottom status bar includes playback controls, a time display of T = [0,31], a zoom level of 1X, and a time counter of Time 31.

Submitting Final Results

Simscape Mechanics Explorer

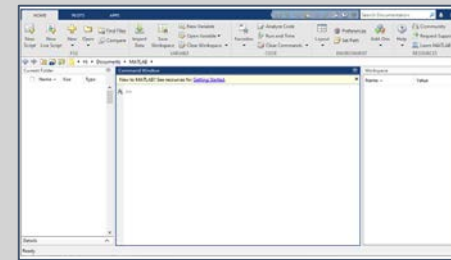


DO NOT Reset or Restart
(will lose the results)

Create/Save Video
of the Phase Run

Switch to
MATLAB
Window

MATLAB Command Window



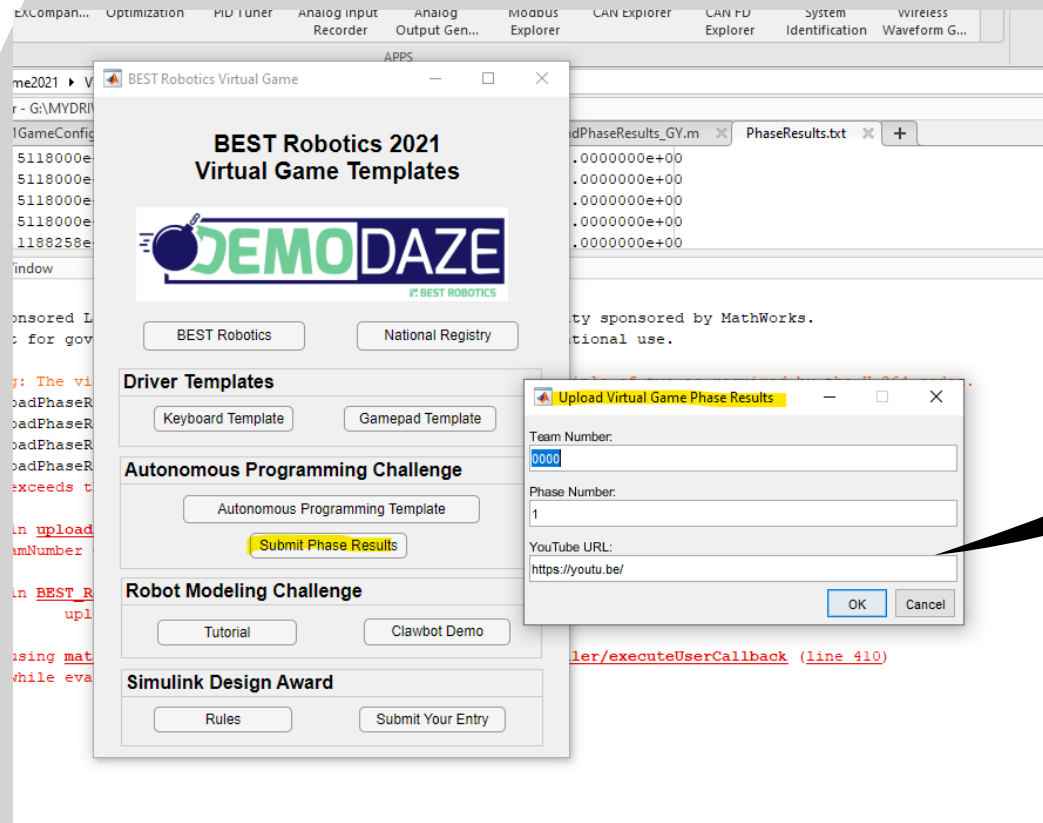
Execute the
uploadPhaseResults script

Complete the
Form Accurately

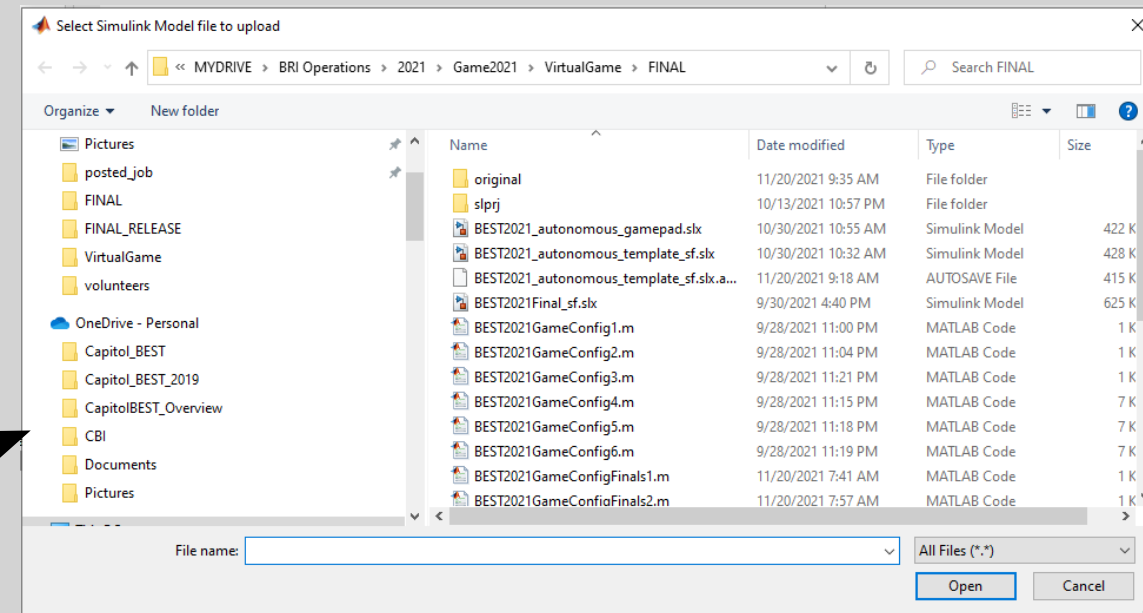
Check for the
Upload Confirmation

**Accuracy is
YOUR responsibility!**
Team # or UserID #
Game Config #
SLX Model
Video

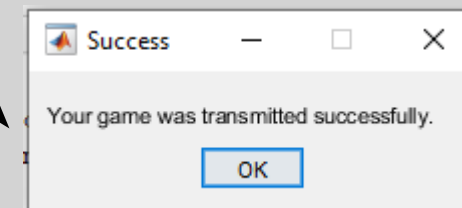
Submitting Final Results



The screenshot shows the 'BEST Robotics 2021 Virtual Game Templates' window. It features a 'DEMODAZE' logo and several challenge categories: 'Driver Templates' (Keyboard Template, Gamepad Template), 'Autonomous Programming Challenge' (Autonomous Programming Template, Submit Phase Results), 'Robot Modeling Challenge' (Tutorial, Clawbot Demo), and 'Simulink Design Award' (Rules, Submit Your Entry). A small 'Upload Virtual Game Phase Results' dialog box is overlaid on the 'Submit Phase Results' button, with fields for Team Number (0000), Phase Number (1), and YouTube URL (https://youtu.be/).



The screenshot shows a file selection dialog box titled 'Select Simulink Model file to upload'. The current directory is 'MYDRIVE > BRI Operations > 2021 > Game2021 > VirtualGame > FINAL'. The file list includes folders like 'original', 'slprj', 'FINAL_RELEASE', and 'VirtualGame', and files such as 'BEST2021_autonomous_gamepad.slx', 'BEST2021_autonomous_template_sf.slx', 'BEST2021Final_sf.slx', and several 'BEST2021GameConfig' files. The 'File name' field is empty, and the file type is set to 'All Files (*.*)'. An arrow points from the 'Submit Phase Results' button in the previous screenshot to this dialog box.



The screenshot shows a 'Success' dialog box with the message 'Your game was transmitted successfully.' and an 'OK' button. An arrow points from the file selection dialog box to this success message.

Autonomous Programming Challenge

Summary



- 8-week programming challenge
- Autonomous Programming Only
- Local Software or MATLAB Online
- Final Game Configs available in final week (7 days for best run)
- Multiple Game Configs & Objectives to run (6 total)
- Submission deadline (results + video + slx model)
- Team ranking and awards (for 2021 BEST teams)
- Individual ranking and awards (all participants)

Autonomous Programming Challenge

RULES RELEASE



Complete Rules for each Phase
will be released on March 5, 2022

EXAMPLE

<u>Phase</u>	<u>Objectives</u>	<u>Simulation Time</u>
1	Item a	45 sec
2	Item b	60 sec
3	Items a,b	60 sec
4	Items a,b,c	120 sec
5	Items a,b,c,d	180 sec
6	All items	unlimited

Autonomous Programming Challenge Registration



- Students REGISTER to participate at
 - <http://spring2022apc.eventbrite.com>
- I participated on a 2021 BEST team?
 - Enter your Team Number from your 2021 BEST Team
- Did not participate on a 2021 BEST team?
 - No problem, you can still participate!
- All participants will receive a participant UserID# on Kickoff day

MORE QUESTIONS?
apc@bestinc.org