



Fused Realities, LLC

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# **Wear Your Robot**

## **Instruction Manual**

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This document describes the system requirements, installation, and use of *Wear Your Robot*, an augmented reality interface for controlling unmanned systems with reduced reliance on two-handed operation.

# Wear Your Robot

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## 1.0 INTRODUCTION

### 1.1 PURPOSE

Wear Your Robot enables users with the ability to control robotic arms with their hands. Using hand tracking technology, you can control robotic arms in a more natural way than complex controllers and joysticks.

### 1.2 SYSTEM REQUIREMENTS

- Windows 7 or newer OS
- Graphics Card with Direct X 9 or Direct X 11 capabilities.
- CPU: AMD Phenom II or Intel Core i3/i5/i7 processor (or better)
- Minimum of 4 GB RAM
- Leap Motion™ for controlling the simulation and live robot with your hand (Gamepads and Keyboard & mouse are also supported)
- USB 2.0 port for direct serial connection to a live robot and ports for any directly connected video cameras.
- USB 2.0 port for Leap Motion™ sensor

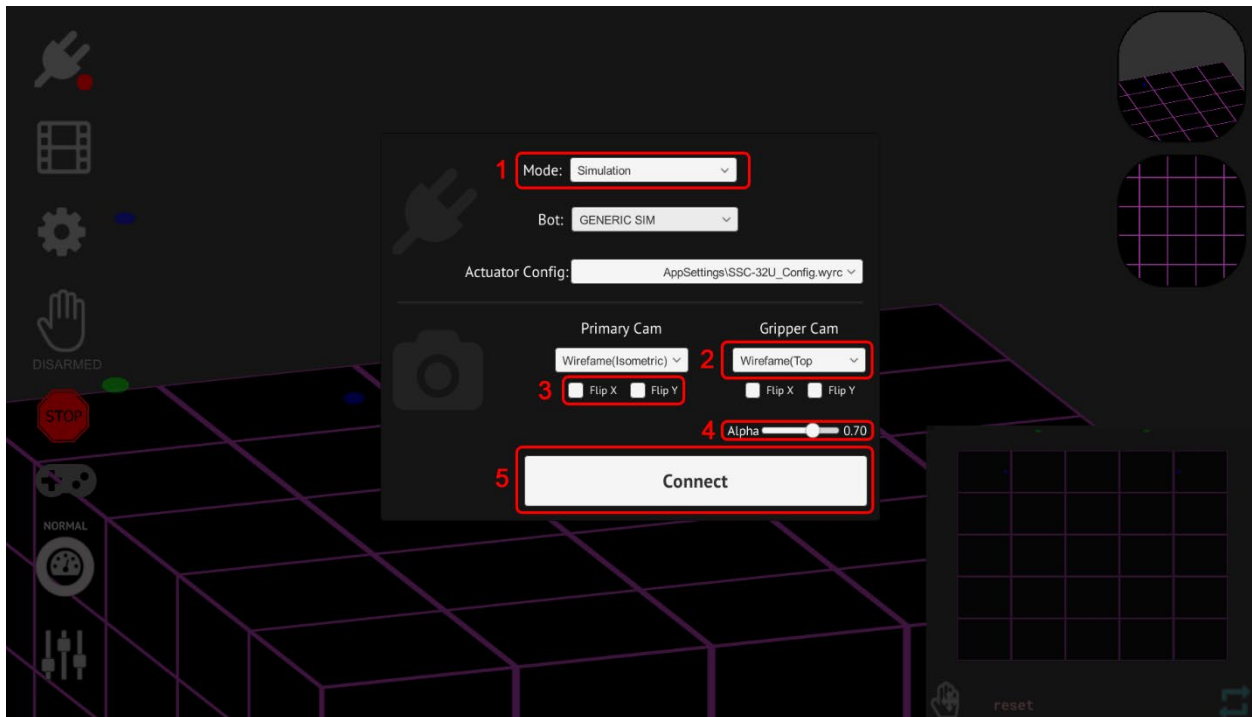
### 1.3 INSTALLATION

1. Extract the contents of the ZIP file by double clicking the file and moving the contents to a folder of your choosing.
2. Double click on the WearYourRobot.exe and the application will start.
3. Leap Motion™ setup instructions can be found on their webpage (<https://www.leapmotion.com/setup/desktop/windows>).
4. Setting up a robot arm to be controlled (LynxMotion only):
  - Connect all webcams to your computer.
  - Connect the Serial USB adapter to your computer. In your Windows' device manager ensure that the device shows up as a COM port.
  - Connect the robot arm's power supply(s).
  - Switch on the power to the robot arm.
  - Ensure the baud rate on the arm is set to 115200.
  - Ensure all actuators are connected to the pins defined in your ActuatorConfiguration. Defaults for SSC-32U AL5D arms are as follows:
    - 0 - ShoulderYaw
    - 1 - ShoulderPitch
    - 2 - ElbowPitch
    - 3 - WristPitch
    - 4 - Gripper
    - 5 - WristRoll

## 2.0 USER INTERFACE OVERVIEW

After launching the application by double clicking on the EXE file you will be presented with the connection menu.

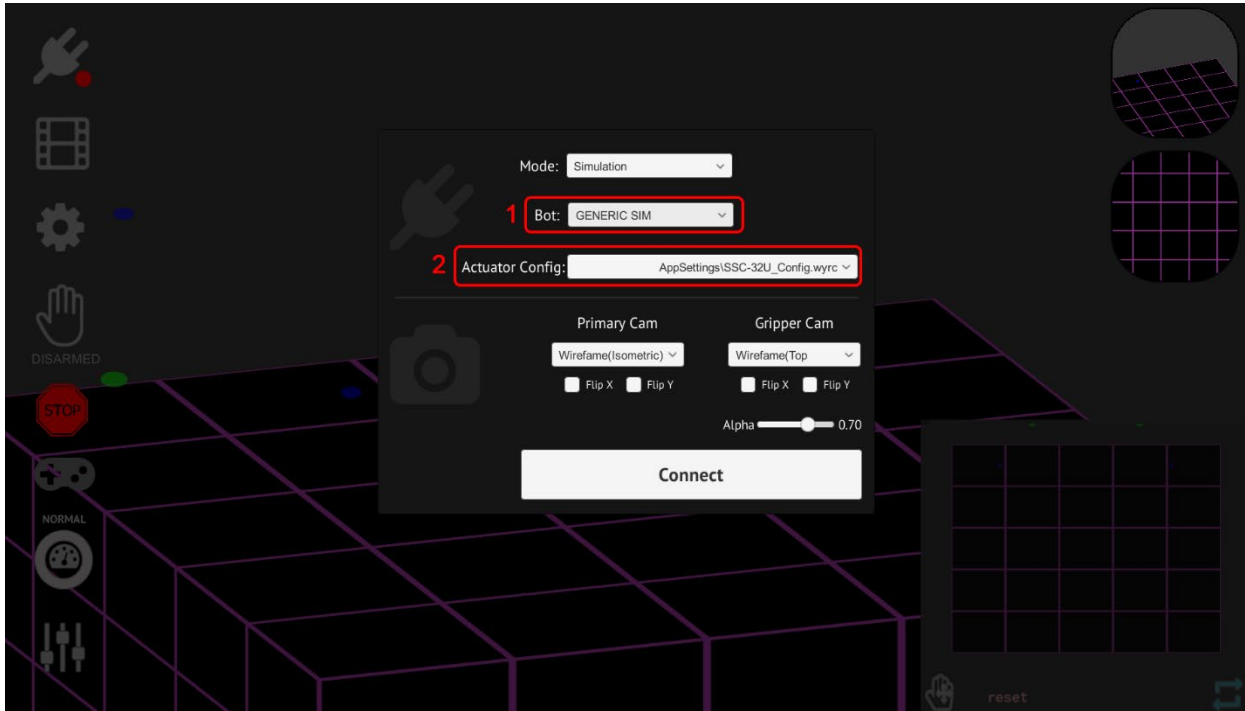
## 2.1 CONNECTING



1. **Mode dropdown:** Sets the current connection mode (**Simulation**, **COM**, or **Bridge**. See 2.1.0).
2. **Camera dropdown:** Shows a list of available cameras. Webcam feeds, virtual cameras, and streamed video feeds will be found here.
  - a. The camera selected as “primary” will be displayed full screen as the main camera view. This camera should be the one that is set away from the arm and can view most of it as it moves.
  - b. The gripper camera will be displayed in a small window in window in the lower right of the screen. This camera should be the one that looks directly at the arm’s gripper.
3. **Camera orientation toggles:** Flips the given camera feed on the X or Y axis.
4. **Gripper cam alpha slider:** Sets the transparency of the gripper feed (bottom right corner).
5. **Connect button:** Click to connect and enter control mode using current settings

## 2.1.0 Connection Modes

*Simulation connection mode is for controlling virtual robots entirely within Wear Your Robot.*

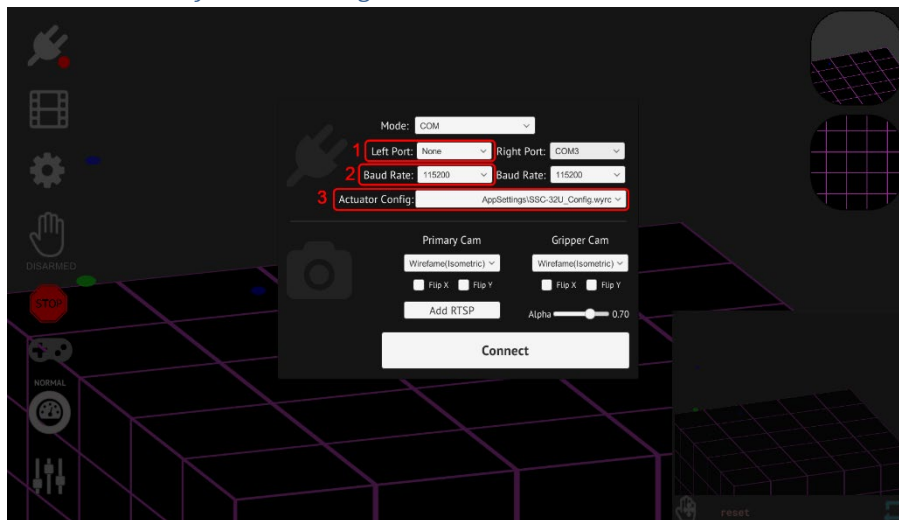


### 1. Bot selection:

- a. **GENERIC SIM** will work with any actuator configuration.
- b. **TALON SIM** is a simulation of controlling a model of the Foster-Miller Talon UGV. Control of the UGV's arm can be accomplished with a Leap Motion™ controller or via the on-screen sliders. Driving the UGV can be accomplished via keyboard arrows, a gamepad (such as an XBOX controller), or the on-screen joystick. other both options are specific to their configs.
- c. **ARDEC DUAL ARM 1** (military customers only).

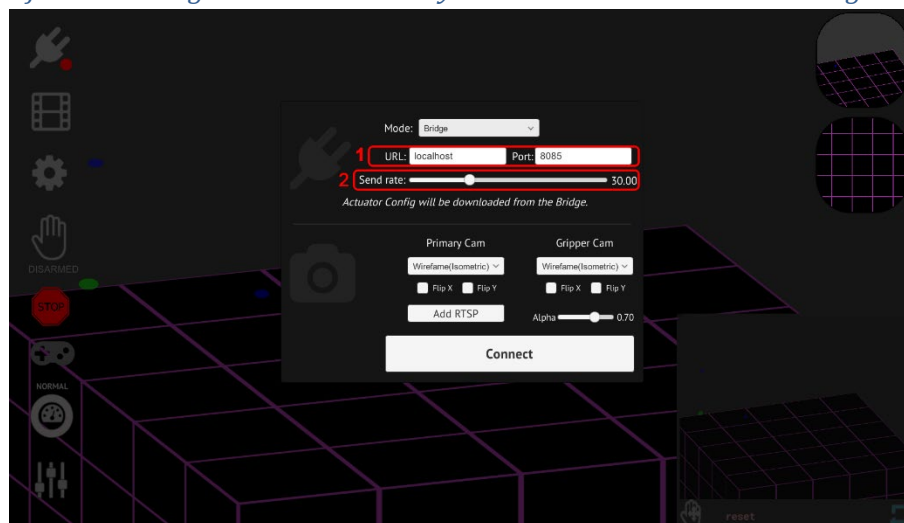
### 2. Actuator config: Select or browse for an actuator configuration to use. Automatically selected for **Talon** and **ARDEC DUAL ARM 1**.

*COM (serial port) connection mode is for controlling live robots connected via USB.*



1. **Port selection:** Select the port for the given arm. Select **None** for the inactive arm if the robot you wish to control only has one arm. *Ensure that you set **None** for the correct arm, if your actuator config only defines joints for the left arm, and you set **None** as the **Left Arm Port**, the arm will not function.*
2. **Baud rate selection:** Set the baud rate for the given arm. Ensure this matches the live arm's settings.
3. **Actuator config:** Select or browse for an actuator configuration to use.

*Bridge connection mode is for controlling live robots remotely via the Common Controller Bridge.*



1. **URL/Port:** The listening address of the instance of Common Controller Bridge that your live bot is connected to.
2. **Send rate slider:** Sets how many messages per second will be sent from WYR to the bridge.

## 2.2 CONTROLLING

After hitting the Connect button, you will enter control mode.

### 2.2.0 Leap Motion™ Controller

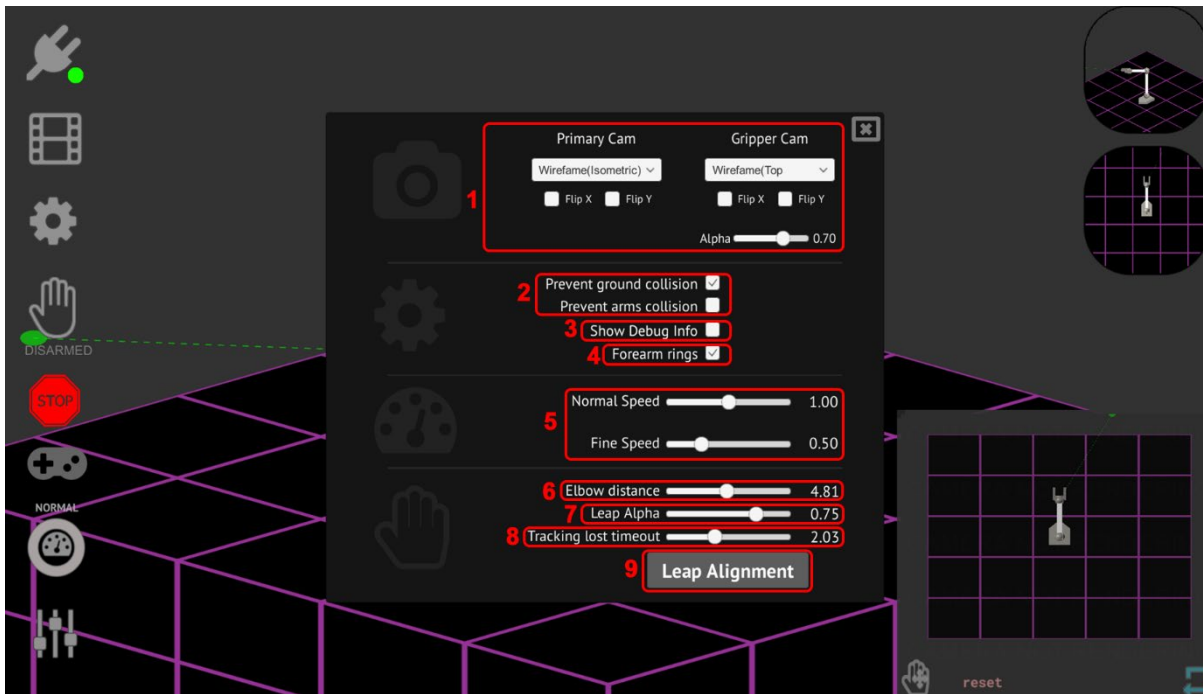
Robots can be controlled with a Leap Motion™ Controller ([www.LeanMotion.com](http://www.LeanMotion.com)). After setting up the Leap Motion™ Controller simply place your hand within view of the controller and the robot's arm will follow the motion of your arm. You can pinch your fingers together to close the gripper.



#### 2.2.1 Interface Overview

1. **Disconnect button:** Disconnects from the current robot and returns to the connection menu
2. **Recording:** Opens the recording menu which allows the user to record Leap hand inputs and play them back.
3. **Settings:** Opens the settings menu (see 2.3)
4. **Arm toggle:** Arms/disarms the current robot and displays armed status. Arming will occur after a brief countdown.
5. **Emergency stop:** Press to send a command to set all actuators to their STOP angle and disarm the bot. STOP angle defined in actuator configuration (see 3.1)
6. **Controller indicator:** Lights up when controller is connected.
7. **Control speed toggle:** Toggle between fine and normal control modes (see 2.3)
8. **Actuator sliders toggle:** Use sliders to control individual actuators on the current robot. IK will be disabled when this panel is open, and there will be no arming countdown.
9. **Mini arm displays:** View an automatically generated simplified view of the current robot, generated based on selected actuator configuration.
10. **Gripper cam feed:** Secondary camera feed.
11. **Swap feeds button:** Swaps secondary camera and main camera views.

## 2.3 SETTINGS



Press the gear button while in control mode to enter the settings menu.

### 2.3.1 Main Settings

1. **Camera Settings:** Same as those present in the Connection Menu (see 2.1)
2. **Prevent ground/arms collision:** If checked, the simulation will attempt to prevent the arm from interpenetrating with the ground or the other arm (ground defined in actuator configuration (see 3.1)
3. **Show debug info:** If checked, then debug info on current actuator angles will be shown in the top left.
4. **Forearm Rings:** Enables/disables the forearm rings. Used in **Talon Sim**.
5. **Fine/Normal speed sliders:** Defines the multiplier for fine/normal speed (switch between these using toggle, see 2.2.1). This changes how much moving the leap hand moves the IK tracking position. **Fine speed** should be lower than **normal speed** so that it is more precise (same hand motion results in less motion), but this is left up to the user. *If both are set to the same value, there will be no difference when switching between the two.*
6. **Elbow distance:** Determines how far the elbow tracking point (blue dot) is projected from the hand tracking point (green dot). Increasing this will improve elbow responsiveness at the cost of hand responsiveness.
7. **Leap alpha slider:** Sets the transparency of the wireframe leap hands
8. **Tracking lost timeout:** How many seconds of lost tracking will be tolerated before the robot is automatically disarmed.
9. **Leap Alignment button:** Opens the Leap Alignment menu. Opening this menu automatically closes the settings menu. Open the settings menu and press this button again to close the Leap Alignment Menu (see 2.3.1)



### 2.3.2 Leap Alignment Menu

The Leap Alignment Menu allows the user to change the on-screen position and orientation of the wireframe leap hands to better match up with the robot being controlled.

- **Depth** moves the arm closer or farther from the camera.
- **Vertical** moves the arm up/down.
- **Horizontal** moves the arm left/right.
- **Pitch** rotates the arm up/down on the right axis.
- **Yaw** rotates the arm left/right on the up axis.
- **Roll** twists the arm on the forward axis