

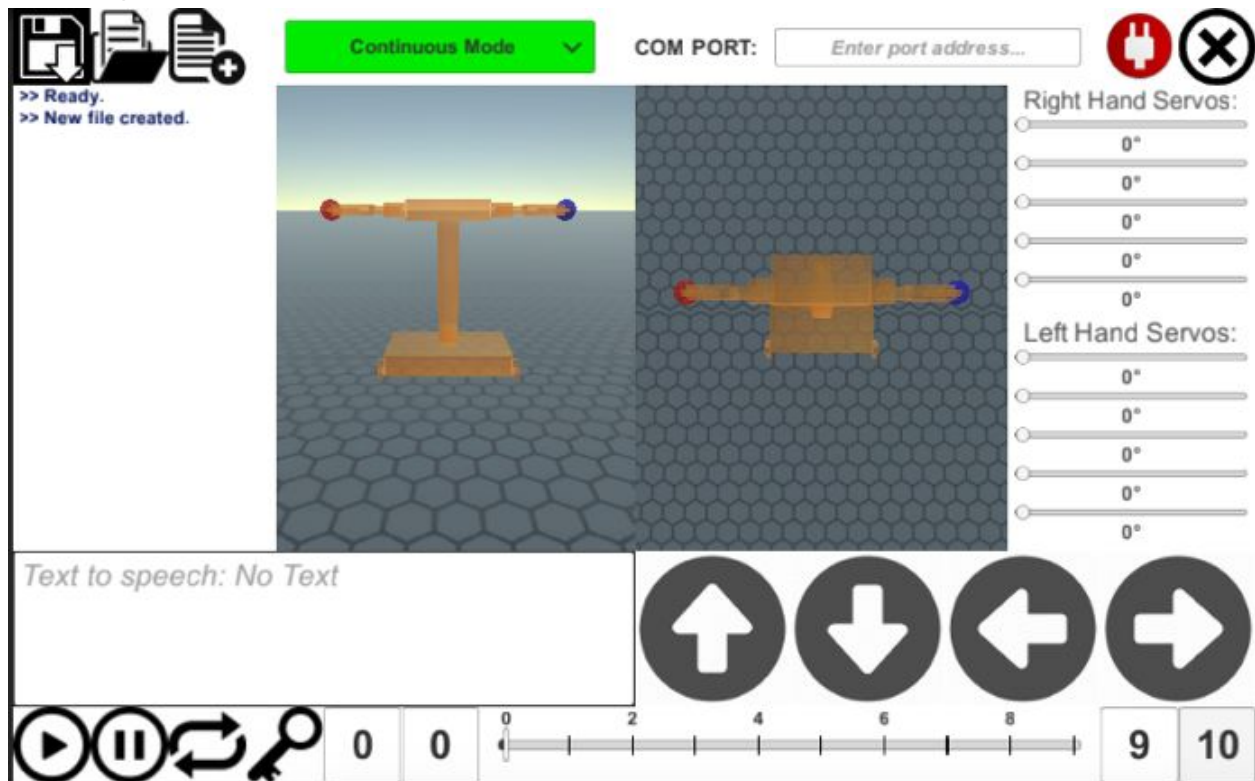
MMM Unity Controller Documentation

Introduction

The MMM Unity Controller acts as a way to connect and control the MMM robot through a user's computer. It allows the user to either freely command the wheels and arms of the robot through manipulating a simple model, or create a keyframe-based animation that the real life robot mimics, which can be run, looped or saved for later use. Lastly, the controller can also act as a server to be used by multiple android based controllers.

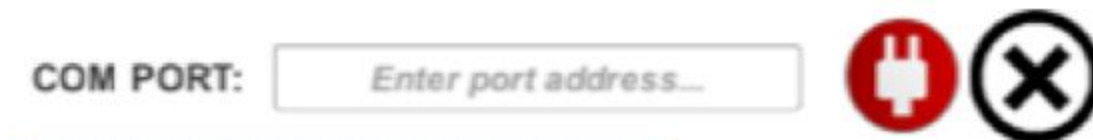
Graphic User Interface

Following is the main interface of the MMM controller.:



In the top menu bar, the user can find the main menu buttons.

Firstly, at the top right part of the screen there exist the connect and quit application buttons:



The text field labeled “COM PORT” prompts the user to name the port in which the USB is connected to the robot. After doing so, the user can click the red connect button to initialize the connection. If the connection is successful, the button will turn green and the console located at the left of the screen will display a success message. Press the button while it is green and the computer disconnects.

The X button is the application quit button. When the user is done using the MMM control, they can press this button and immediately disconnect along with quitting the app.

Next to the connection and application quit buttons there is the mode selection button. We will go after what each different mode does, but for now it's best to just describe the basics of changing modes. Initially the controller is set to off mode:



When the user clicks the mode control list, a drop down list of all available options appears and the user has the option to click on any of them to change to that mode.

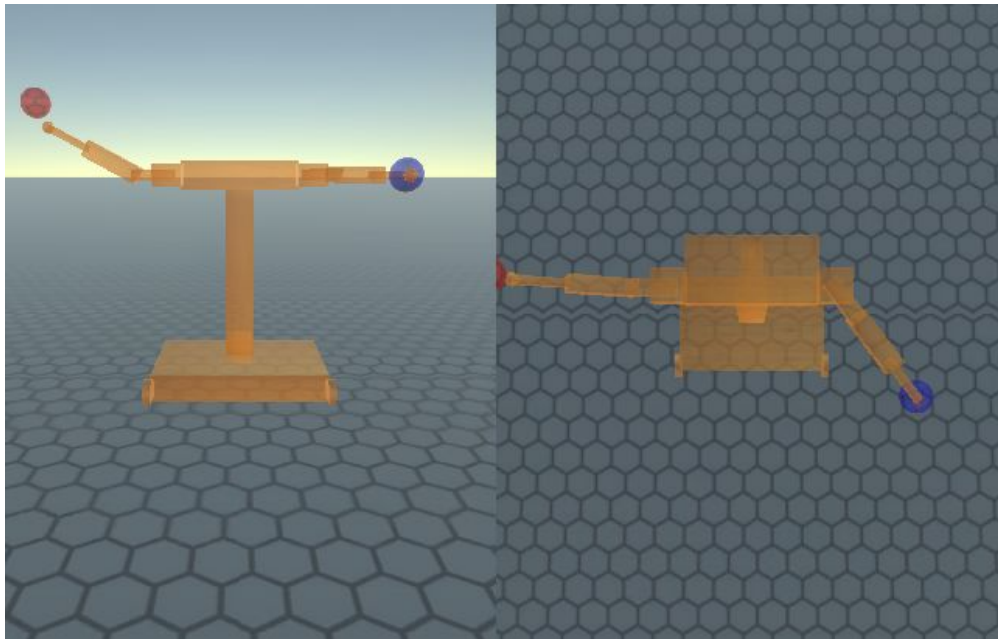


Next to the mode control there exist the three file controlling buttons. Since those are mostly used when creating animations, their use will be better explained there. In summary, the first acts as a save button for animations, the second one loads an already existing animation and the third one creates a new file, or a new blank animation.

Under the file control buttons is the console. The console notifies the user when a file is saved or loaded, when the robot is successfully connected or when there are errors.

```
>> Ready.  
>> New file created.  
>> Saved successfully at:  
/Users/dims/Documents/mmm  
app/savedData/animation.MM  
M
```

In the center of the screen the user can see and manipulate a model of the robot. The robot mirrors the model in real time. The user can interact with the model by clicking on the red and blue orbs and dragging them to specific positions. The two views provide two different planes of movement. The model's arms will follow their corresponding orb. This enables the user to accurately determine the position of the robot's arms in a simple and easy way.



On the right of the model the user can alter the grippers attached to the end of the arms of the robot. Each slider represents one of the five servos in each hand. The user is then able to accurately change and set the positions of each gripper to be mirrored by the robot.



Below the grippers are the movement buttons that control the base of the robot. The buttons correspond to forward, backward, turn left, and turn right. The buttons can either be toggle buttons or normal buttons depending on the mode of the controller.



Left of the movement buttons, the user can utilise the text to speech function of the robot. By typing any sentence or words in the text box provided, the robot will speak those specific lines. Moreover, this feature can be used in an animation. The text to speech function has a character limit of 140 characters per frame.



Finally, the bottom bar is the animation bar. This area will be detailed in a later section.

Modes

The MMM Unity Controller has, as mentioned before, four modes:

Off Mode

Continuous Update Mode

Playback Mode

Mobile Control Mode

Off Mode

The controller's off mode is the default mode that the application starts on. In this mode the user can experiment with different animations for the robot or different positions using the model provided, without worrying about the actual robot, since in off mode all communication between the robot and the controller is shut off.

Continuous Update Mode

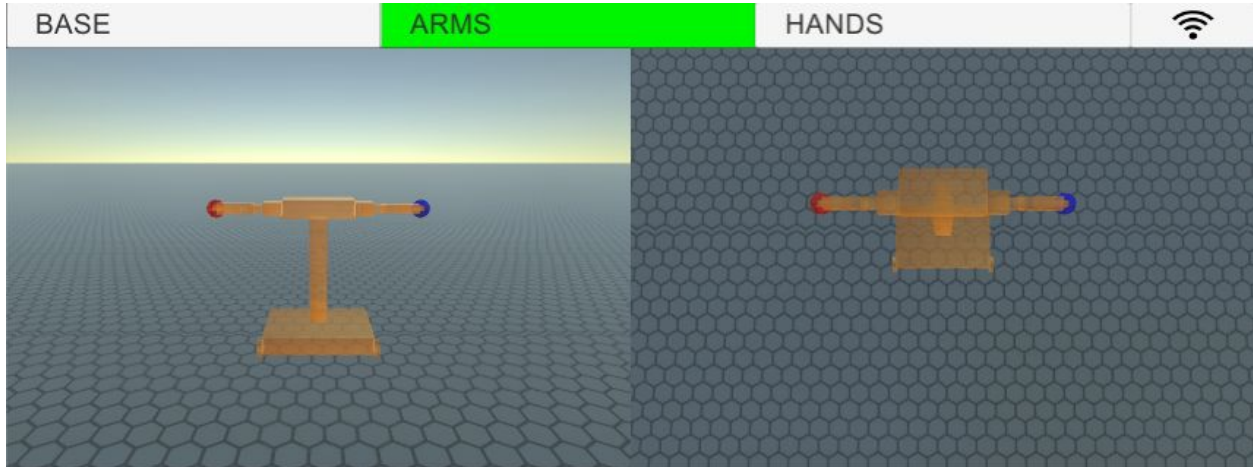
The continuous mode causes the robot to follow the model on screen in realtime. All changes in the controller are immediately reflected in the robot. This mode is ideal for directly controlling the robot. This mode also changes the movement buttons to normal buttons, where the button must be held to carry out its action.

Playback Mode

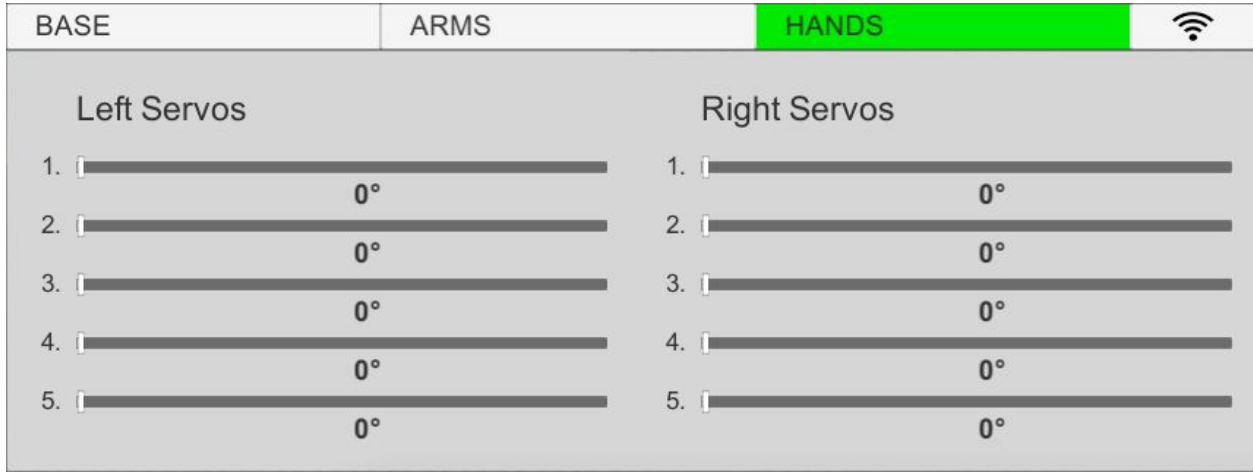
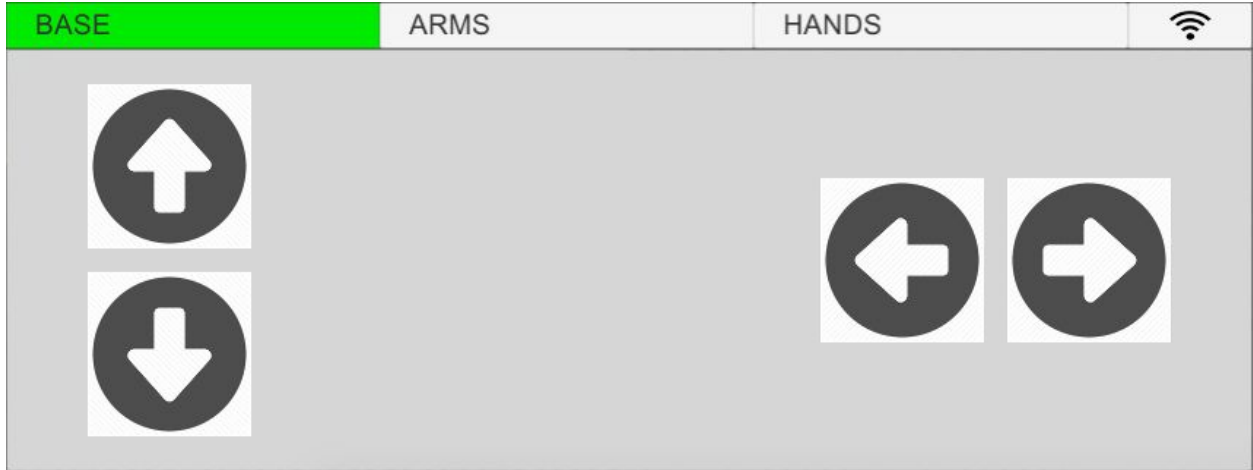
In Playback mode, the robot only reflects the model on screen during playback of an animation. Meaning, an animation with keyframes must be created and the play button must be pressed before any changes are reflected. This mode is ideal for testing out animations or playing back a previously saved animation.

Mobile Control Mode

In this mode the user does not control the robot using the MMM Unity controller. The interface dims and prevents the user from interacting with most of it. In this mode, an android mobile device must run the MMMAndroid app. In this app the user is presented with a simpler layout:



The window contains three tabs: one for controlling the base, one for the arms and one for the hand grippers.



At the far right there also exists a connect button for the android to connect with the computer and send data to the robot:



However, in order to connect, the user has to be in the same Wifi network as the computer. If they are, simply pressing the connect button and waiting for a bit until it turns green is enough to establish a connection. To disconnect simply click the button again while it is green. Note that certain WiFi firewall settings could block the connection.



The three tabs work independently. Therefore it is possible for the robot to be controlled by three different android devices, one in each tab. Thus, the users have more maneuverability when in this mode, but cannot have the robot speak or create a custom animation and save it.

IMPORTANT: When connecting, make sure your view is on an unoccupied tab. Otherwise, you will override another person's controls.

It is important to remember that in order to control the robot in mobile mode, the computer controller itself must first be connected to the MMM.

ALSO IMPORTANT: Remember to disconnect before closing the app, or the computer will continue to act as if you were connected.

Animation

This is the animation bar:



From left to right, the buttons are in the following order:

Some of those actions can be performed with the press of a key (provided in brackets next to its name)

1. Play button(Spacebar) - Starts or ends playback of the animation.
2. Pause button (P) - Pauses or continues playback.
3. Loop button (L) - While toggled, the animation restarts upon reaching the end
4. Keyframe button (K) - Press to switch between a keyframe and a normal frame at the current time slider position.
5. Current frame number - Displays the current frame number. Can be changed to jump to a specific frame (can only be changed to a value between the start and end frame).
6. Start frame number - Displays the start of the current view. Playback will begin here and loop from here. Can be edited to any value between 0 and the end frame number.
7. Frame slider - Every tick on the bar is one frame. The user can click to go to any frame.
8. End frame number - Displays the end of the current view. Playback will end here. Can be edited to any value between start frame number and the total frame number.
9. Total frame number - Displays the maximum amount of frames. Can be changed to any value between 2 and 1000.

The animation process is keyframe based. When the animation is played, the controller steps through each frame at a rate of one frame per second. If the frame is a keyframe, the model will update all the buttons and positions. In playback mode and continuous mode, this would mean the robot will also move.

To create a keyframe, simply move the model to the desired position, toggle any desired movement button, and then click the keyframe button. The tick on the frame slider will turn red to indicate it is a keyframe:



In this image, frames 1 and 3 are keyframes.

At any time, the user can save the animation by clicking the save button to save the animation as a .MMM file. Animations can also be loaded using the load button.