



Bridging Mixed Reality
Capstone 2018



ARPD RS User Manual

*Augmented Reality Product Design Review System
(ARPD RS)*

Camosun Innovates

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Introduction

Welcome! This user manual will help guide you through working with the ARPDRS project in the following ways:

- Updating the application in the Development Environment
- Interacting with the application in the Active (Deployed) Environment

What is the ARPDRS project?

The ARPDRS project is an application that allows Camosun Innovates to prototype in the 3D digital domain utilizing the Microsoft HoloLens. This digital prototyping will allow for a faster development workflow for engineers alongside a reduction in material costs. For more details, see the Software Design Document or other documentation.

Important information while reading the user-manual:

- Sentences highlighted in **RED** are information that is essential.
- Sentences highlighted in **BLUE** are tips that are helpful but not necessarily required.

The Development Environment

What is the Development Environment?

The Development Environment is where you update the ARPDRS Hololens application. This primarily involves managing the Prototypes available in the application.

Important! Before You Get Started

This User Manual assumes that you have installed the required development software for the ARPDRS project as detailed in section 9.2 of the Software Design Document (version 1.0).

Adding a New Prototype to the Application

This step will teach you how to add a new Prototype to the project.

Open the Project in Unity

1. Open *Unity* from the *Start Menu*
2. Click on the *Open* button in the top right of the page (see Figure 1.1)



Figure 1.1 - Unity's project selection splash screen. The *Open* button is highlighted in the green box.

3. Navigate to the folder you placed the ARPDRS source code in.
4. Double-click the ARPDRS folder to reveal the ARPDRS-Hololens-App folder (see Figure 1.2).

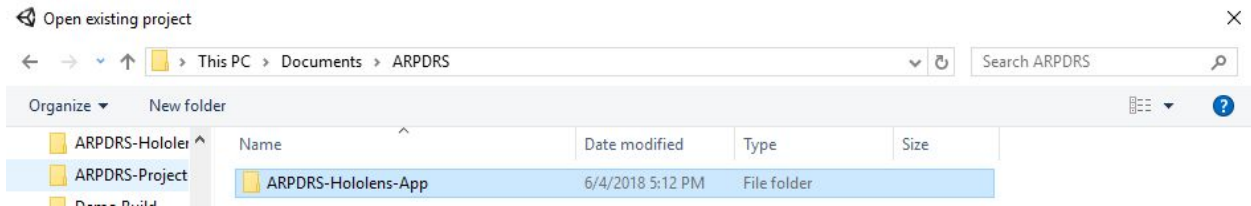


Figure 1.2 - Unity's project selection browser. The ARPDRS Hololens Unity project is stored inside this folder.

5. With the ARPDRS-Hololens-App folder selected (highlighted), click *Select Folder* in the bottom right.

Unity should now open the ARPDRS Hololens project.

Add a Prototype to the Project

This step assumes you have the ARPDRS Unity project open.

Before we get started, there is an **important** constraint to be aware of before adding new Prototypes to the application: as of **version 1.0**, the ARPDRS app can **only contain 10 custom Prototypes in the Resources folder**. This is due to a design constraint that may be addressed in future iterations. **If more than 10 Prototypes are added, only the first 10 will ever be loaded and an error will be thrown by the application.**

1. In the bottom left of the screen, navigate to the *Resources* folder nested inside the *Assets* folder (see Figure 1.3).

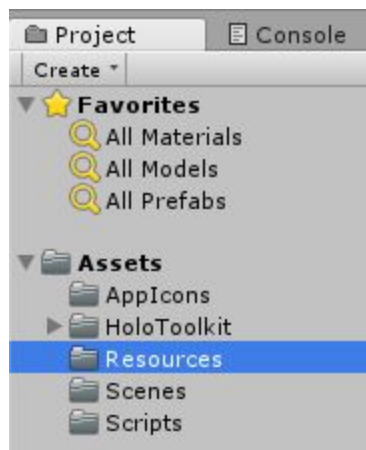


Figure 1.3 - Unity's project navigation UI. The *Resources* folder is nested inside of the *Assets* root folder.

2. Inside this folder will be several *Prefabs* - saved *Unity Game Objects* that can be displayed in the scene (see Figure 1.4).

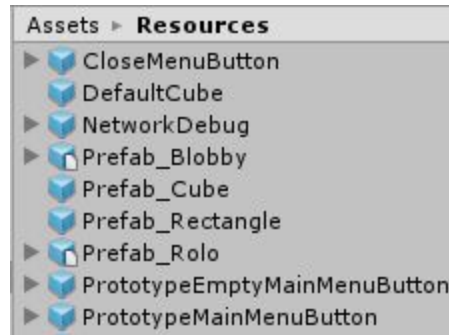


Figure 1.4 - The *Prefabs* currently stored in the project.

Note how several are prefixed with *Prefab_*. This designates the *Prefab* as a spawnable Prototype in the ARPD RS application logic. This naming convention must be followed when adding or modifying prototypes.

Warning! If you do not prefix your prototype with this naming convention, your model will not be loaded!

3. Drag your FBX file into this folder to add it as a new Prototype.
4. Rename the *Prefab* to "*Prefab_*" plus the name you want your Prototype to be associated with (see Figure 1.5).

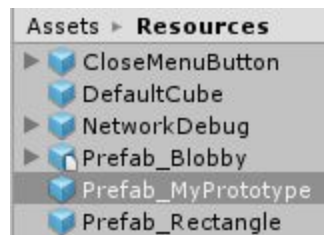


Figure 1.5 - A new Prototype renamed to "*MyPrototype*". When the ARPD RS Hololens App is running, a button will be called *MyPrototype* in the Main Menu.

Note: This name is used throughout the application to identify your prefab. It is also used to generate the name displayed in the Prototype selection menu (the Main Menu).

5. (Optional) Drag your new Prototype into the scene to see how it will look when spawned and adjust its default size.
6. **Important!** If you make changes to the Prototype in the scene in anyway, make sure to update the *Prefab* by selecting the Prototype

in scene: select the *GameObject* drop down menu and then the *Apply Changes To Prefab* option (see Figure 1.6).

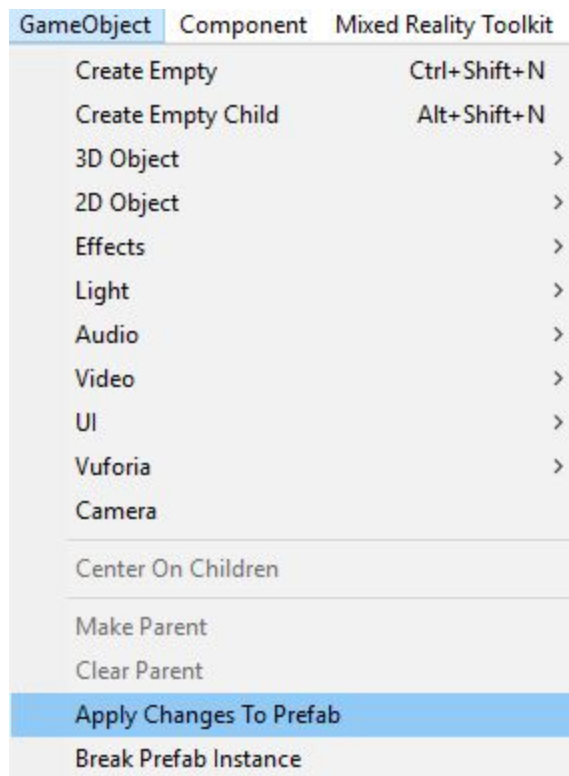


Figure 1.6 - The *Apply Changes To Prefab* option. This is required to save changes made inside of Unity to prefabs.

After re-deploying the ARPD RS Hololens Application with these changes, your new Prototype should be selectable from the Main Menu.

Removing an Existing Prototype from the Application

This step will teach you how to remove an existing Prototype from the project.

It is actually very simple to remove a Prototype. Select the Prototype in the *Resources* folder and hit *Delete* on your keyboard. Accept the Unity warning and you are done. There are no lingering dependencies to worry about.

Warning! - Do not modify project files from outside of Unity! Unity tracks files using metadata and the project could become unbuildable as a result.

Warning! - This step is not reversible! Be careful!

Deploying the Hololens Application

This step will teach you how to deploy the ARPDRS Hololens Unity project to a Hololens device. This is a fairly lengthy but straightforward process.

Building the Unity Project

Before you can deploy the application, you must first Build it from inside the Unity Editor.

1. In the Unity Editor, select the *File* dropdown menu. Then select *Build Settings* (see Figure 1.7).

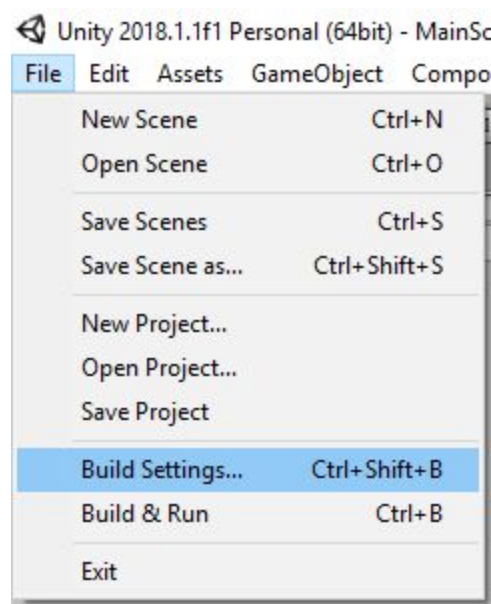


Figure 1.7 - The *Build Settings* option is highlighted in the *File* dropdown menu

2. Click the *Build* button in the bottom right (see Figure 1.8 below).

Warning! Do not touch any of the build settings unless you know what you are doing. They will break the build process if you are not careful.

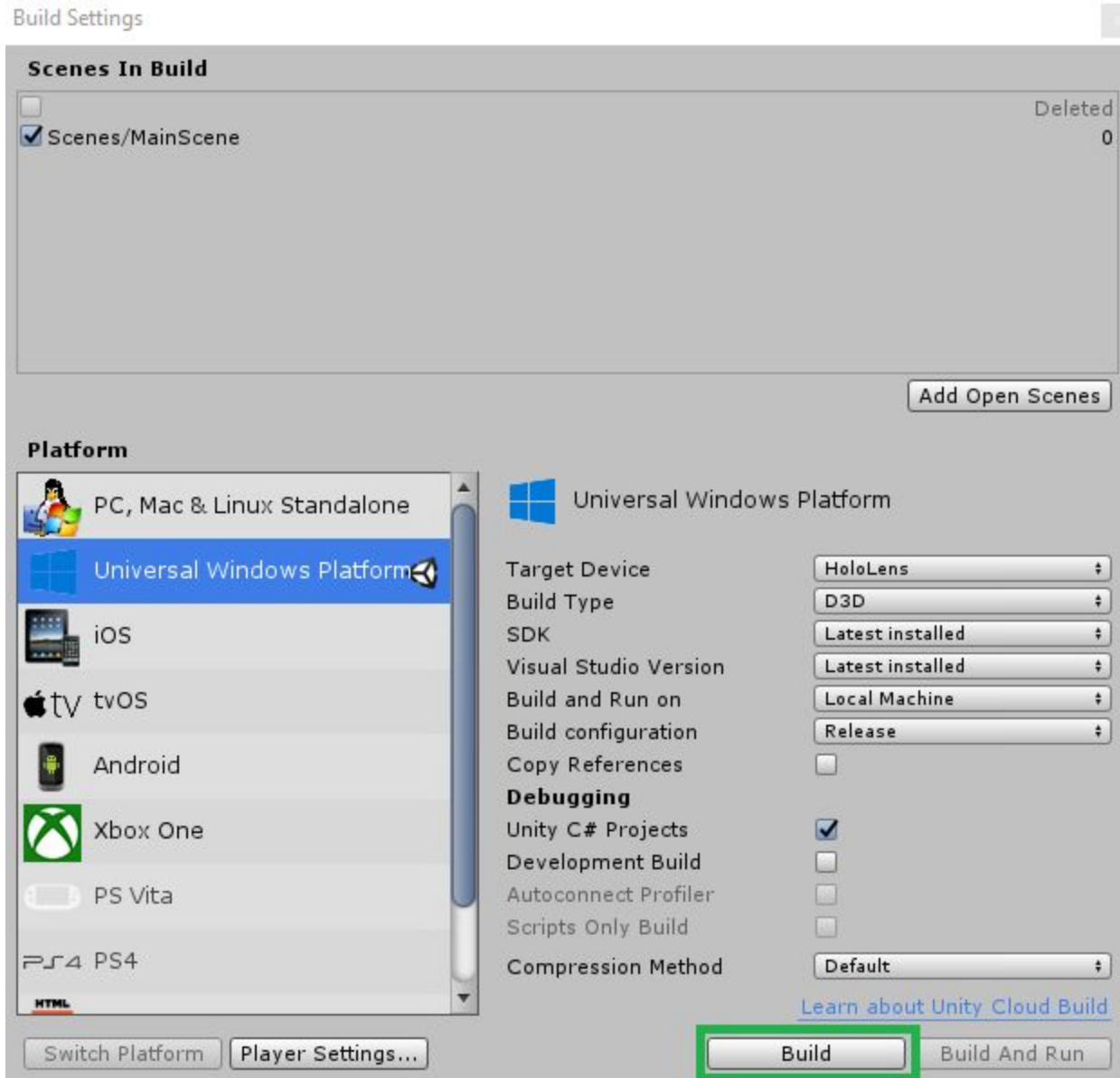


Figure 1.8 - The *Build Settings* screen. The *Build* button is highlighted in green in the bottom right. **Do not hit the *Build And Run* button, it will try to install it to the local computer and this will fail!**

3. Select where to store the build files in the File Explorer window that appears.
4. Press the *Select Folder* button to build. The build progress bar will now appear (see Figure 1.9).



Figure 1.9 - The Build Process progress bar.

This is a temporary build location so the location does not matter. Just make sure you remember where it is for the next step.

When the dialog closes, you have successfully built the Unity project.

Deploying with Visual Studio

Now that you have a built Unity Project, you must deploy it to the HoloLens using the Visual Studio Editor.

This step requires you to have the IP Address of your HoloLens device. If you do not know how to do this, see the **Grabbing Your HoloLens IP Address** section.

1. Navigate to where you stored your Build from the Unity Editor.
2. Double-click on the folder.
3. Double-click on the file called *ARPD RS HoloLens App.sln* (see Figure 1.10 below). Visual Studio will launch and load the Unity Build.

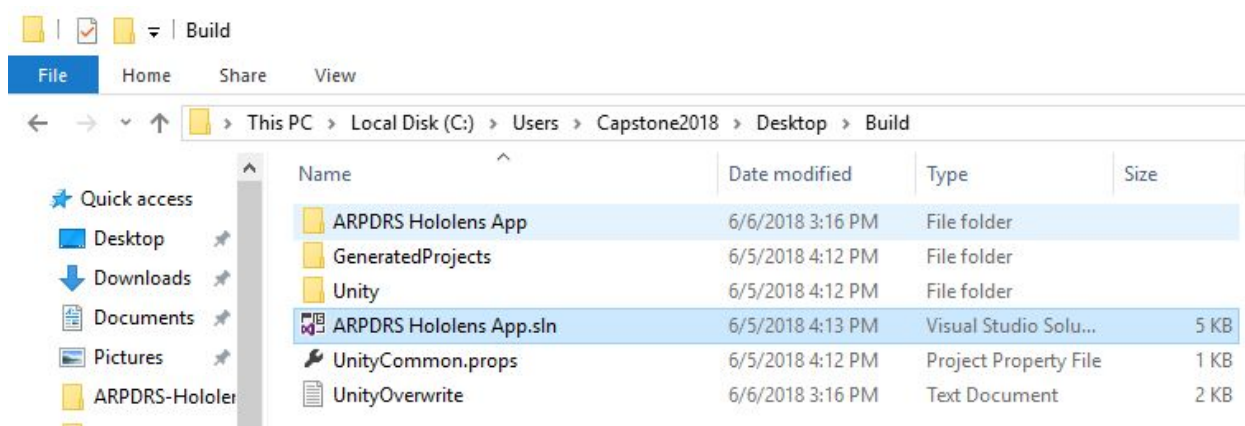


Figure 1.10 - The Visual Studio file called *ARPD RS HoloLens App.sln* is highlighted. Double-click it to launch Visual Studio using the Unity Build.

4. At the top middle of the UI, change the following settings using their drop-down menus to match Figure 1.11 below.

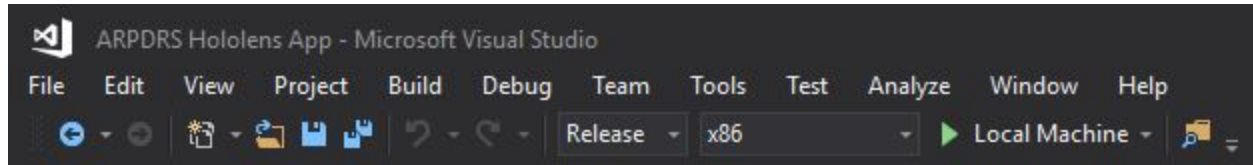


Figure 1.11 - The Deployment Settings are at the bottom right of this screenshot. Make sure yours match.

5. Ensure that *Release* and *x86* are the selected options.

Warning! - Visual Studio defaults to *Debug* and *ARM* which will not work for the Hololens.

6. Change *Local Machine* to *Remote Machine* using its drop down menu (the little arrow to the right of *Local Machine* in Figure 1.11). A Remote Connections dialog will pop up.
7. Enter the IP address of the Hololens address into the Address Field (see Figure 1.12). Press the Select button when done.

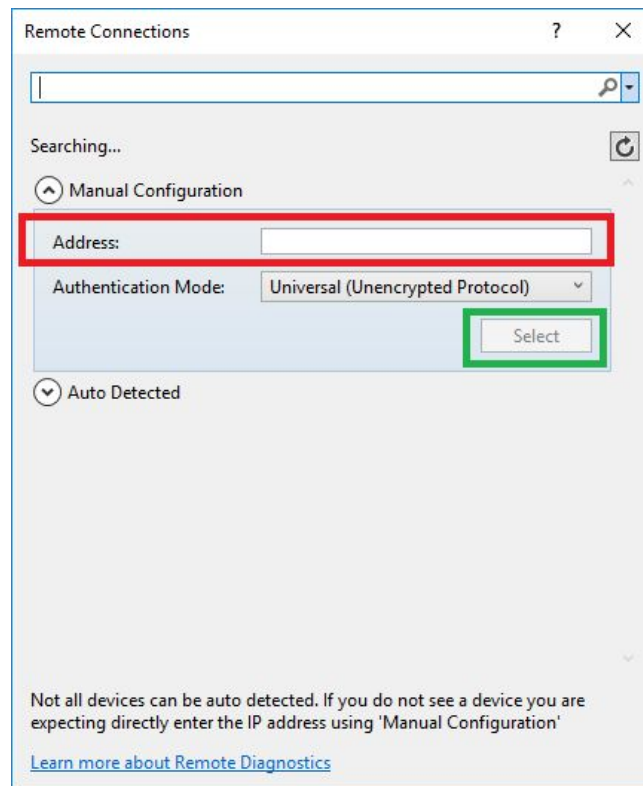


Figure 1.12 - The Remote Connections dialog box. The red highlighted area is where the IP address of the Hololens device goes. The green box is the button to press when done.

8. Deploy the project to the Hololen by selecting the *Build* dropdown menu at the top of the screen. Select the *Deploy Solution* option inside this menu (See Figure 1.13 below). Visual Studio will start deploying to the Hololens.

Warning! Make sure your Hololens device is on before starting this process or it will fail!

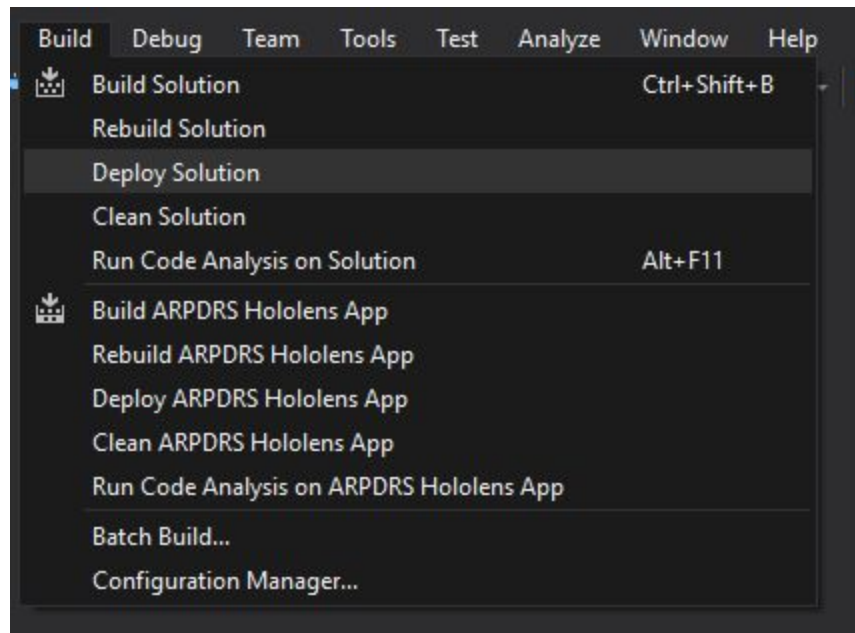


Figure 1.13 - The *Deploy Solution* option is highlighted.

9. Watch the Output text at the bottom of the screen. While the green bar is not full, the deployment is still ongoing (see Figure 1.14). This will take a few minutes.

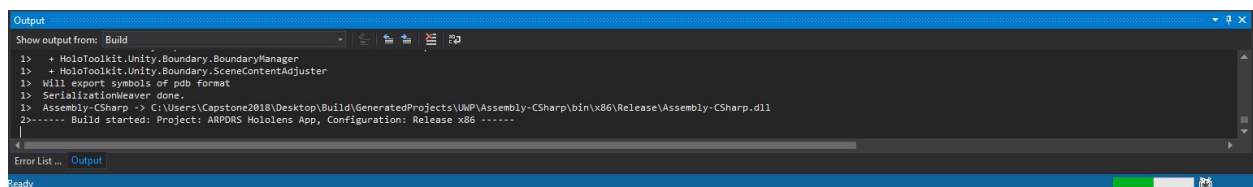


Figure 1.14 - The Solution is deploying. Note the green bar is not full yet.

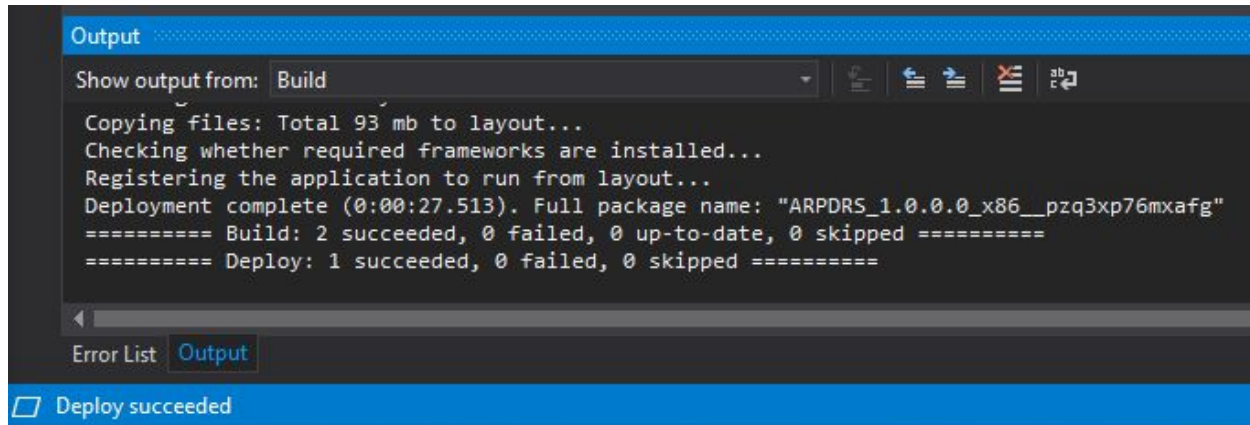


Figure 1.15 - This screenshot shows a successful deployment. Notice the Deploy Succeeded message in the bottom left.

10. (Optional) Once the build is complete (see Figure 1.15 above), you can deploy to the other HoloLens using the following steps.
 - a. Select the *Project* drop-down menu, then *ARPDRS HoloLens App Properties...* (see Figure 1.16 below).

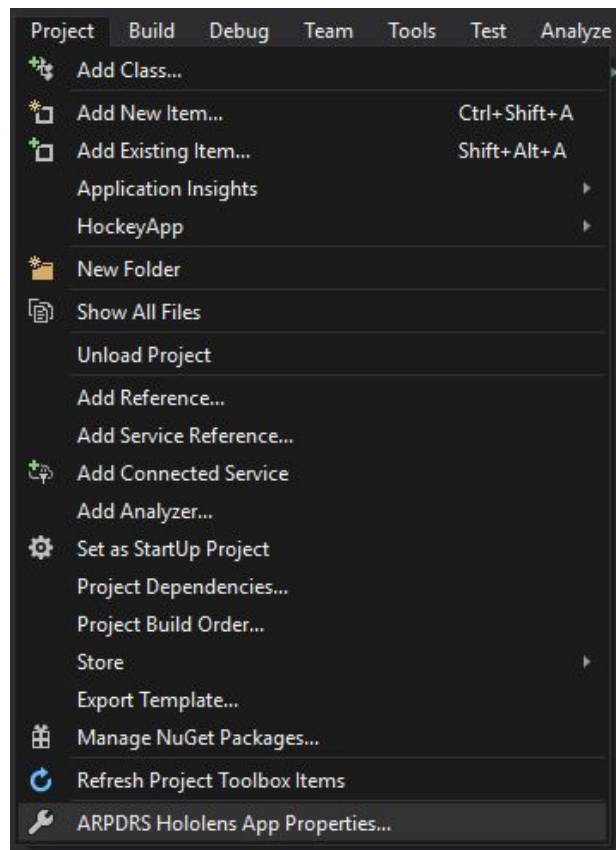


Figure 1.16 - The *Properties* setting is highlighted at the bottom.

b. Select the *Debug* option on the left (see Figure 1.17).

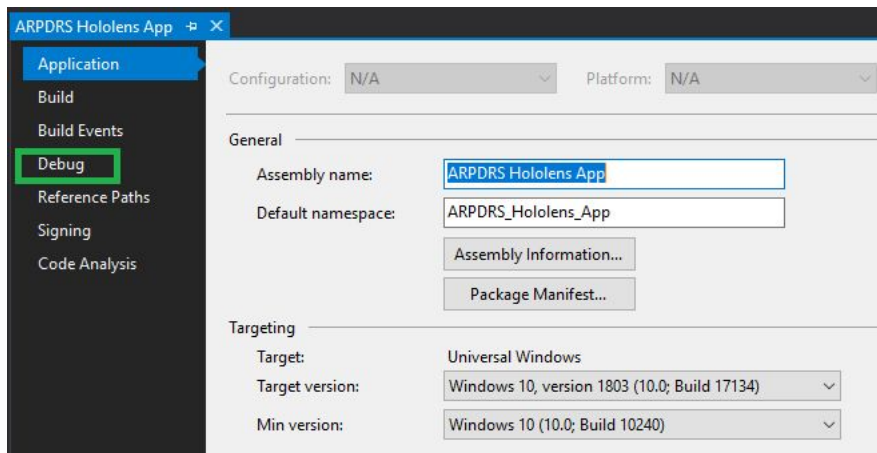


Figure 1.17 - The Properties screen. Notice the *Debug* option on the left highlighted in green.

c. Enter the new IP address in the provided field (see Figure 1.18).

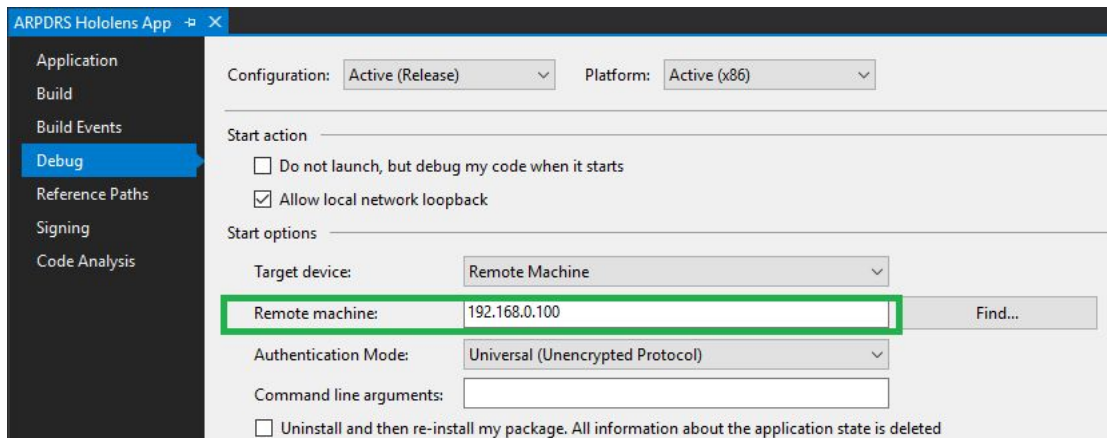


Figure 1.18 - The IP address field is called Remote machine and is highlighted in green.

d. Follow the Deploy instructions from Step 8 to deploy to this new IP address.

11. You can now close the Visual Studio Editor and launch the ARPD RS application on the Hololens. See the Running the Hololens Application for more details.

Finding Your Hololens IP Address

To find your IP address follow these steps:

1. Open the Hololens Main Menu
2. Select *Settings*
3. Select *Network and Internet*
4. Select *Advanced Options*
5. The address you need is the IPv4 field.

For additional help and visuals see Microsoft's documentation:

<https://docs.microsoft.com/en-us/windows/mixed-reality/connecting-to-wi-fi-on-hololens>

The Active (Deployed) Environment

What is the Active (Deployed) Environment?

The Development Environment is where you interact with the ARPDRS Hololens application. This primarily involves managing the Prototypes available in the application.

Important! Before You Get Started

This User Manual assumes that you have already deployed the ARPDRS Hololens Application to the Hololens device. If not, follow the instructions in the Deployment Environment.

Launching the Sharing Service

This step will teach you how to start the Sharing Service to enable the ARPDRS Hololens application to work.

Note: A Sharing Service is **required** for the ARPDRS Hololens application to run, even if it is the only Hololens device.

1. Navigate to inside the ARPDRS source code folder (see Figure 2.1).

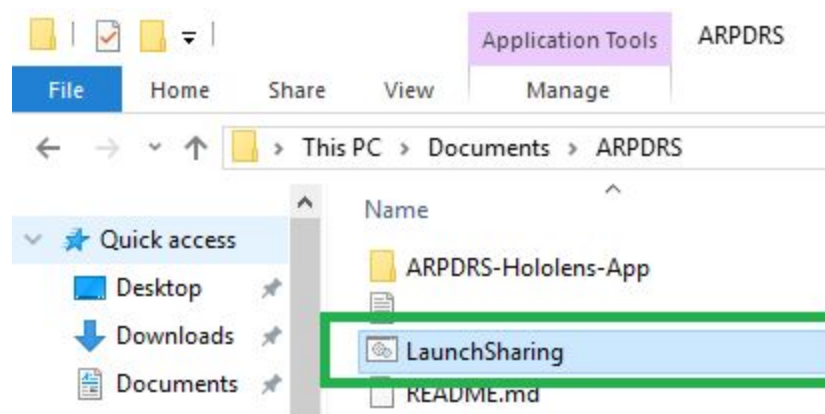
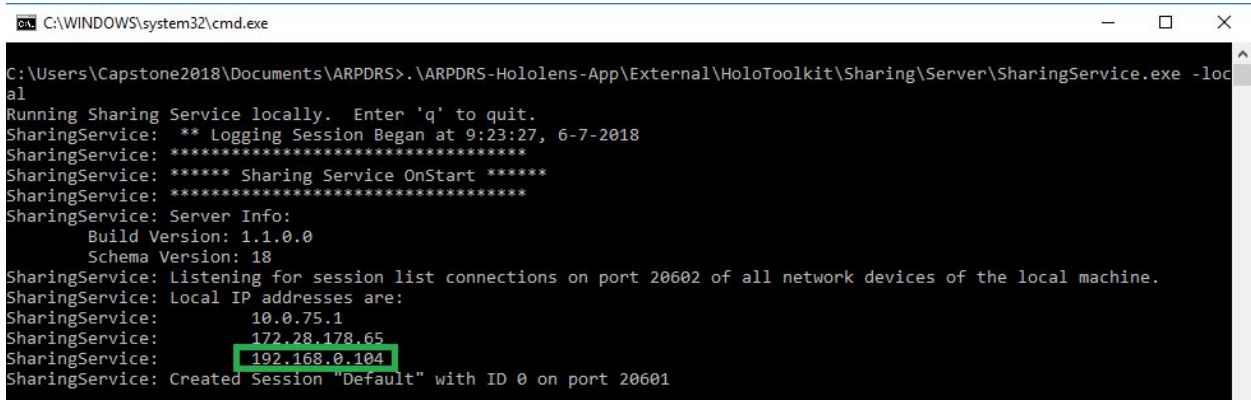


Figure 2.1 - The ARPDRS source code with the Sharing Service file highlighted. This file starts the Sharing Service.

2. Double-click the *LaunchSharing* file. This will start the Sharing Service and a window will appear (see Figure 2.1)



```
C:\WINDOWS\system32\cmd.exe
C:\Users\Capstone2018\Documents\ARPRS>.\ARPRS-Hololens-App\External\HoloToolkit\Sharing\Server\SharingService.exe -local
Running Sharing Service locally. Enter 'q' to quit.
SharingService: ** Logging Session Began at 9:23:27, 6-7-2018
SharingService: *****
SharingService: ***** Sharing Service OnStart *****
SharingService: *****
SharingService: Server Info:
Build Version: 1.1.0.0
Schema Version: 18
SharingService: Listening for session list connections on port 20602 of all network devices of the local machine.
SharingService: Local IP addresses are:
SharingService: 10.0.75.1
SharingService: 172.28.178.65
SharingService: 192.168.0.104
SharingService: Created Session "Default" with ID 0 on port 20601
```

Figure 2.2 - The Sharing Service status window. The IP Address of the service is highlighted in the green box.

3. The Sharing Service will display the status of all Network connections. You can see the IP Address of the Service here as well (See Figure 2.2 above).
4. This window **must** remain open. If you close the window, the Sharing Service will stop.

Warning! - The Sharing Service provides a list of IP Addresses it can listen on. However, the Hololens can only communicate with the Sharing Service with the IP Address that corresponds to its own IP Address range. ie If the Hololens is 192.168.0.100 then it needs to know the Sharing Service IP that matches the 192.168 prefix. This is normal IPv4 behaviour. For more info, talk to a network professional.

Closing the Sharing Service

Stopping the Sharing Service is very straightforward:

1. Select the Sharing Service window.
2. Close the window or hit "q" and then "Enter".
3. The Sharing Service is now stopped.

Starting the ARPDRS Hololens Application

This step will teach you how to add a new Prototype to the project.

This step assumes you have launched the Sharing Service on the Host computer. If not, see the *Launching the Sharing Service* section for more details.

1. Select the ARPDRS app from the menu (see Figure 2.3 below). A placeable menu will open (see Figure 2.4 below).



Figure 2.3 - The ARPDRS Hololens App icon is highlighted.



Figure 2.4 - The ARPDRS Hololens App placeable menu.

2. Place the menu anywhere in room. The application will start.
3. The first screen you will see is the network screen (see Figure 2.5 below).

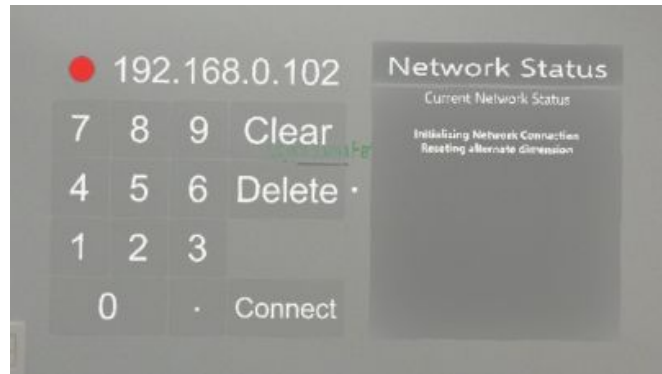


Figure 2.5 - The Network Status screen. The IP Address to connect to is highlighted in the green box.

At this point you need to know the IP Address of the Sharing Service. If you don't know the IP Address, look at the window that appears when the service starts. See *Launching the Sharing Service* for more details.

4. If the IP Address matches the IP Address of the Sharing Service machine, skip the rest of this step. Otherwise update the IP Address to match the Sharing Service machine (see Figure 2.5 above).
 - a. To enter a new IP Address first hit the Clear button or the Delete button to alter the current IP Address (See Figure 2.5 above).
 - b. Now use the pad buttons to type in the new IP Address.
5. With the correct IP Address inputted, click the *Connect* button to connect. A spinning Icon will appear indicating the application is trying to connect (see Figure 2.6 below).

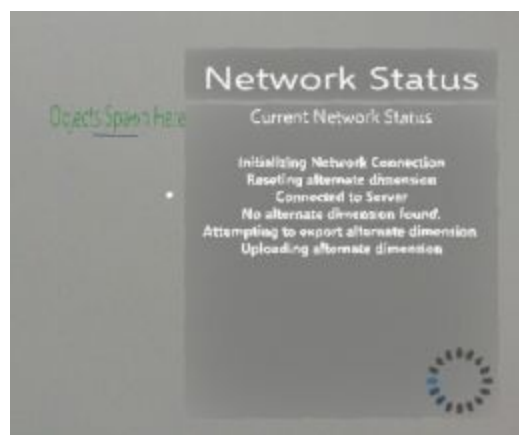


Figure 2.6 - The Progress indicator. As long as this is spinning, the application is still trying to connect to the Sharing Service.

6. The Network Status screen will close if it successfully connects. The Main Menu should be visible instead. If it did not, see Step 7.
7. There was a problem connecting to the Sharing Service. A message will appear on the right side of the screen with more details. Additionally, the indicator light will be red (see Figure 2.7). Ensure the IP Address is correct and that the Sharing Service is running.

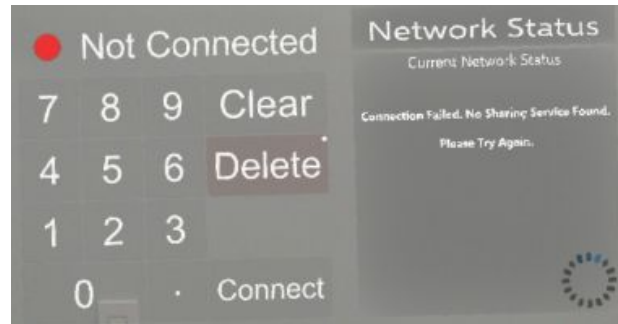


Figure 2.7 - The indicator light is red. The text status update is in the column on the right.

Accessing the Help Menu

This step will teach you how to access the Help Menu in the Hololens application. The Help Menu provides a list of voice commands for interacting with the application.

1. The Help Menu is available at any point **after** the Network has been connected.
2. To open the Help Menu either click the Information Button in the top left of the screen (See Figure 2.8) or use the voice command "Show Commands"



Figure 2.8 - The Information button is highlighted with a green box. This button will try to follow your gaze in the application. Sometimes it may not be visible.

That is because it is just off the screen to the left. Looking in that direction will cause it to re-appear.

3. The Help Menu will now open (See Figure 2.9 below). A list of commands will be visible.

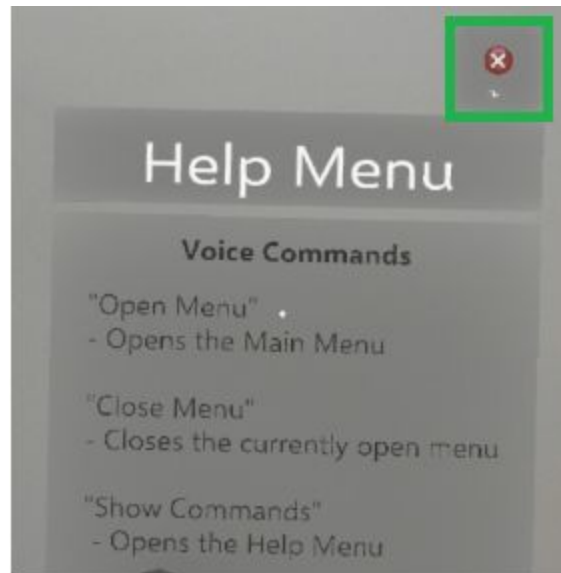


Figure 2.9 - The Help menu. The Close button is highlighted with a green box.

4. To exit the Help menu either click the Close button in the top right of the menu (See Figure 2.9 above) or use the voice command "Close Menu".

Interacting with a Prototype in the ARPDRS Hololens Application

This step will teach you how to interact with a Prototype to the application.

Creating a Prototype

This step will teach you how to create a Prototype to interact with.

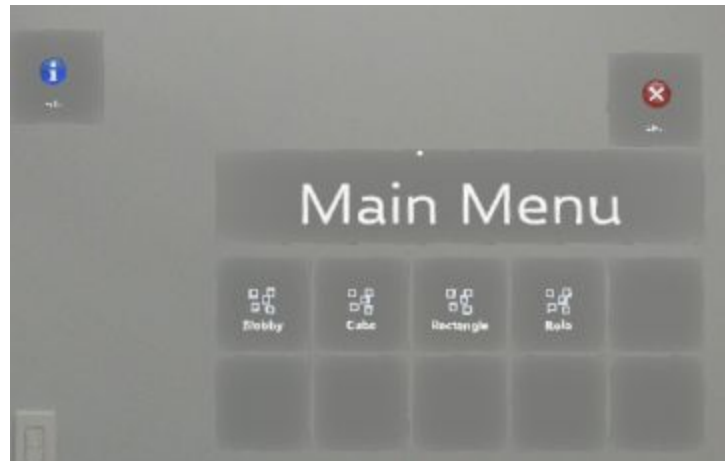


Figure 2.10 - The Main Menu Screen. This is opened by default once the application has connected the Sharing Service.

1. You should currently be in the Main Menu Screen (see Figure 2.10 above). If not, perform the following steps:
 - a. Click the *Add Model* button in the top left of the screen (See Figure 2.11 below).

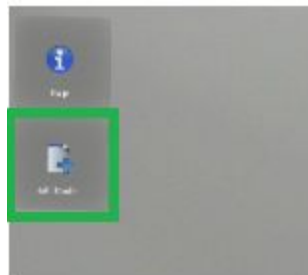


Figure 2.11 - The *Add Model* button is highlighted in green.

- b. The Main Menu should now be open (See Figure 2.10 above)

2. All of the available prototypes are visible by name as buttons in the Main Menu. Select a desired Prototype. The Main Menu will close and the Prototype will appear.

Note: The first person to start the application and connect to the Sharing Service will create the Global Spawn point in front of where they are looking. All Prototypes will be created at this location. The Global Spawn point is labeled with text (See Figure 2.12 below)



Figure 2.12 - The Global Spawn point.

Interacting with a Prototype

This step will teach you how to interact with a Prototype. The ARPD RS Hololens application has several ways to interact with Prototypes:

1. Move
2. Scale (Resize)
3. Rotate
4. Delete

These will be elaborated on below.

Note: If you are unfamiliar with Hololens gestures, see Microsoft's getting started with gestures documentation for more details:

<https://docs.microsoft.com/en-us/windows/mixed-reality/gestures>

This documentation assumes you have a basic grasp of these gestures.

Move

1. Select and hold onto the Prototype using the Air Tap gesture.
2. Move your hand around the screen while holding the Air Tap gesture. The Prototype will follow.
3. Release the Air Tap gesture to release the Prototype.

Scale (Resize)

1. Select and hold onto the Prototype using the Air Tap gesture.
2. While holding this Air Tap gesture, with the other hand perform the same gesture on the Prototype.
3. Move your hands to resize the object (See Figure 2.13 below):

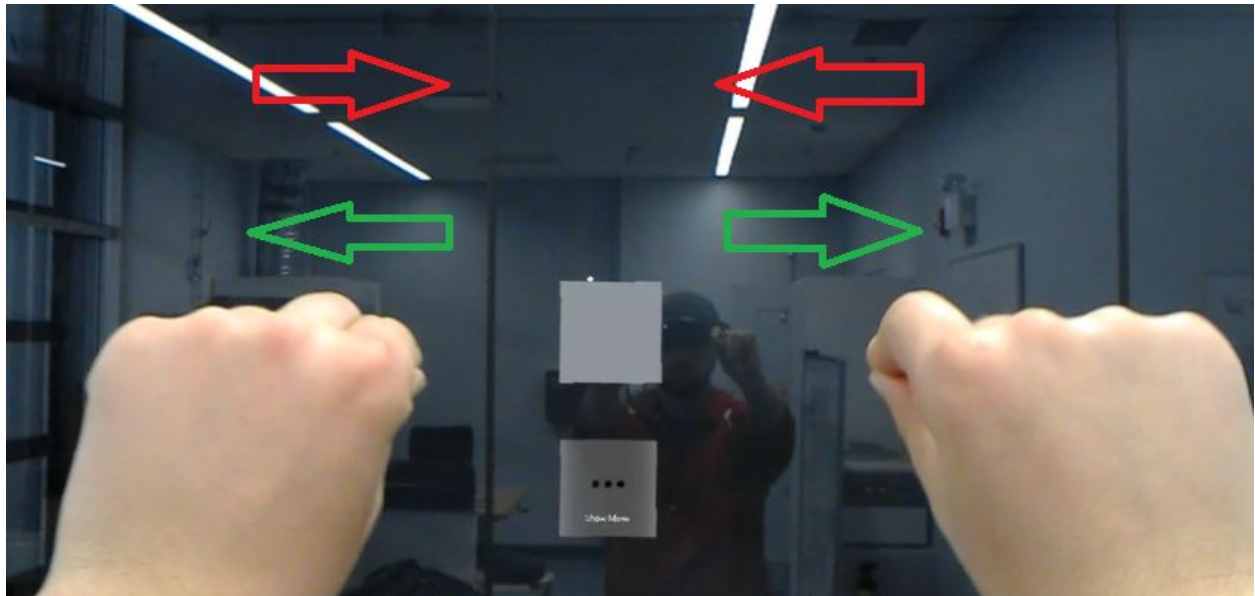


Figure 2.13 - A Prototype being resized. The green arrows show the hand movement to make the Prototype larger. The red arrows show the hand movement to make the Prototype smaller.

- a. Move your hands apart to make the object larger.
 - b. Move your hands together to make the object smaller.
4. Release the Air Tap gesture to stop resizing the Prototype.

Rotate

1. Select the Prototype Sub Menu button to expand the Sub Menu (See Figure 2.14 below). This will reveal additional options.



Figure 2.14 - The Prototype Sub Menu always follows each Prototype. It floats below the Prototype.

2. Select the *Adjust* button (See Figure 2.15).



Figure 2.15 - The *Adjust* option is the second option from the left.

3. The Prototype will now have a box around it with Handles to interact with (See Figure 2.16 below).



Figure 2.16 - The Handles to interact with the Prototype are the blue spheres.

4. Air Tap and hold on a Handle to select the Handle.
5. Drag the Handle in a direction to rotate the Prototype.

Delete

1. Select the Prototype Sub Menu button to expand the Sub Menu (See Figure 2.14 below). This will reveal additional options.



Figure 2.14 - The Prototype Sub Menu always follows each Prototype. It floats below the Prototype.

2. Select the *Remove* button (See Figure 2.15).



Figure 2.15 - The *Remove* option is the option on the right.

Using Voice Commands with the ARPDORS Hololens Application

This section will teach you how to use voice commands with the ARPDORS application. To use a voice command simply say the required keyword in a firm and consistent voice. Currently there are three voice commands supported:

1. "Show Commands" will display the Help Menu.

2. "Open Menu" will open the Main Menu if possible.
3. "Close Menu" will close the currently open menu.

Note: The HoloLens has its own built in voice commands and Cortana will be listening for these as well. These are reserved keywords by Microsoft that will be recognized regardless of the open application. Therefore HoloLens voice commands such as "Select" will work in the ARPDRS application. See Microsoft's documentation for more details:

<https://docs.microsoft.com/en-us/windows/mixed-reality/voice-input>

Exiting the ARPDRS HoloLens Application.

Exiting the ARPDRS app is the same as other HoloLens apps. Use the bloom gesture and remove the ARPDRS window.

Using the ARPDRS HoloLens Application with Multiple Devices

This section will teach you how to connect to the same Sharing Service with multiple HoloLens devices.

Warning! - Make sure you follow these steps exactly. Connecting before the network is setup correctly will cause the application to fail!

1. Connect the First device like normal following the *Starting the ARPDRS HoloLens Application* steps.

Note - The First device sets the World Spawning point in front of them on application launch. Make sure to create it somewhere sensible (an open space). All additional users will use this same Spawning point.

2. Once the First device has made it to the Main Menu, it is safe to connect the Second device.
3. Connect the additional devices using the same steps.
4. Creating, Deleting and Interacting with Prototypes is the same as normal.

The Error Menu

In the event of an error, the ARPD RS application will display an error message on the screen (See Figure 2.16 below). This message will provide details about the error. Some errors may require the application to be restarted. Some errors may cause the application to close automatically.

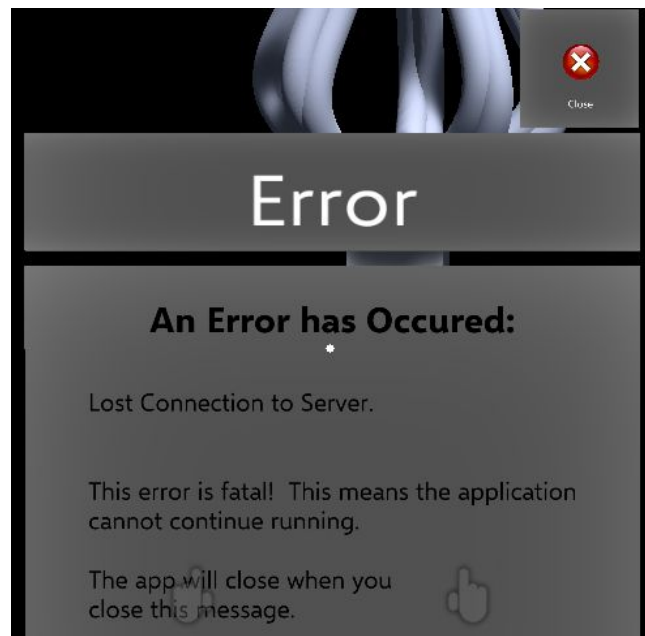


Figure 2.16 - The Error Menu

Conclusion

Congratulations! You should now be able to use the ARPDRS application to its fullest potential. Please keep in mind that this application was built as a prototype itself by Computer Science students at Camosun College as a Capstone Project. We hope your experience will be positive and apologize in advance for any bugs or omissions.

Sincerely,

The BMR Capstone 2018 Team

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