CageView™ Premium User Manual

Quick Start Guide
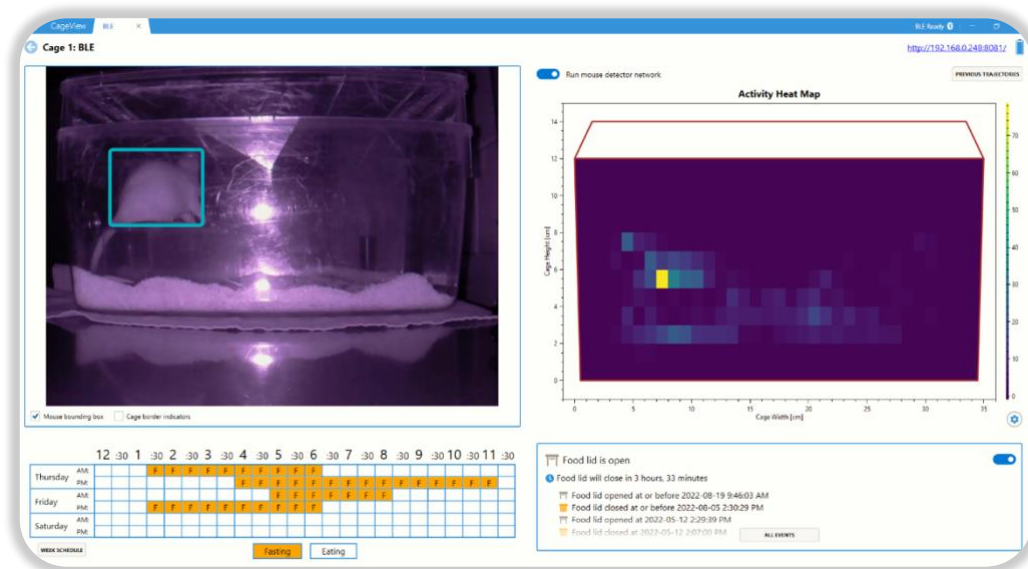
Table of Contents

Important Note:

The CageView App is available on Microsoft Store for free download.

---

1. Introduction

CageView™ is a programmable, detector, and easy-to-handle device used in research centers focusing on biomedical research and animal science. It is designed to provide controlled conditions for measuring food, behavior, drug ingestion, and exercise intensity. It eliminates the need for technicians to measure intake and change the conditions.

Although it has comprehensive and unique features, CageView has a competitive price compared to similar products and is affordable for research laboratories.

CageView™ consists of two separate modules: **CV-SmartFeeder**™ and **CV-SmartVision™.**

1.1.   CV-SmartFeeder™

In most biomedical research studies with rodents (mice and rats), it's essential to provide their daily and hourly food share in a predetermined manner. CageView™ can be programmed to provide access or remove access to the food source anytime and from almost anywhere. Its features include:

- Scheduling feeding plan
- Saving specific feeding plans
- Changing and removing the scheduled plan
- Monitoring the Smart Feeder performance

1.2. CV-SmartVision™

CageView™ is programmable to monitor and record the activities of animals. The tracing mechanism consists of the following:

- Tracing the activity of the animal
- Providing the distribution of the activity location over a specific time step
- Compatible with a varied spectrum of light (Using image/video-processing techniques to eliminate the effect of light)

2. CageView™ Installation Requirements

The following features are the requirements that a machine needs to meet to execute the CageView™ software:

- OS Type: Windows 10 (64-bit)
- OS Version: Version 2004 (OS build 19041.985) [Minimum Tested]

  Version 20H2 (OS build 19042.1052) [Recommended]
- Installed Memory (RAM): 8 GB [Minimum Tested]

  12 GB or more [Recommended]
- Processor: Core (TM) i5-3450 CPU @ 2.10 GHz or equivalent [Minimum Tested]

  Core (TM) i7 4th Gen. CPU and higher or equivalent [Recommended]

Important Note 1: The machine needs to have a working Bluetooth 4+ adapter installed. Most laptops and modern desktop PCs have built-in Wi-Fi and Bluetooth adapters. If your system does not have a built-in Bluetooth adapter, you can utilize an external Bluetooth 4+ dongle.

Important Note 2: For Activity Monitoring, it is recommended to use a machine that has a dedicated GPU.

3. CageView™ Installation Procedure

This section provides easy-to-follow instructions to install CageView™.

3.1 Installing CageView App using installer file (Old Versions)

3.1.1. If you are using the "exe" version of the App, go to the installation folder and double-click on "**CageView (x64).exe**".

Name	Date modified	Type	Size
CageView (x64).exe	2022-02-09 2:59 PM	Application	253,469 KB
CageView (x64).wixpdb	2022-02-09 2:59 PM	WIXPDB File	143 KB

3.1.2. By double-clicking the "exe" file, a window will pop up, as shown in **Figure 1**. Read the "End User License Agreement." If you agree with the Terms and Conditions, check the "I agree to the license terms and conditions" box and click the "Install" button.

Figure 1. Software License Agreement.

Note: When clicking the "**Install**" button, you may be asked to give permission for the installation. Click "**Yes**" if you see this message generated by the OS.

3.1.3. Click the "**Install**" button to start installing software. After installation, the following window will appear, and the software shortcut is created on the Desktop.
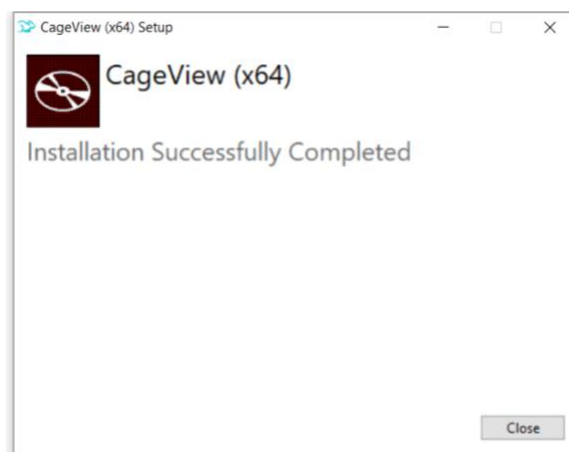

Figure 2. A Message indicating successful installation with a software icon.

3.2 Downloading and Installing CageView App from Microsoft Store (New Version)

3.2.1. Go to the Microsoft Store and search "CageView."

3.2.2. Click on CageView to see a window containing the CageView App description. On the left side of the window, click Install / Get button to download the software.
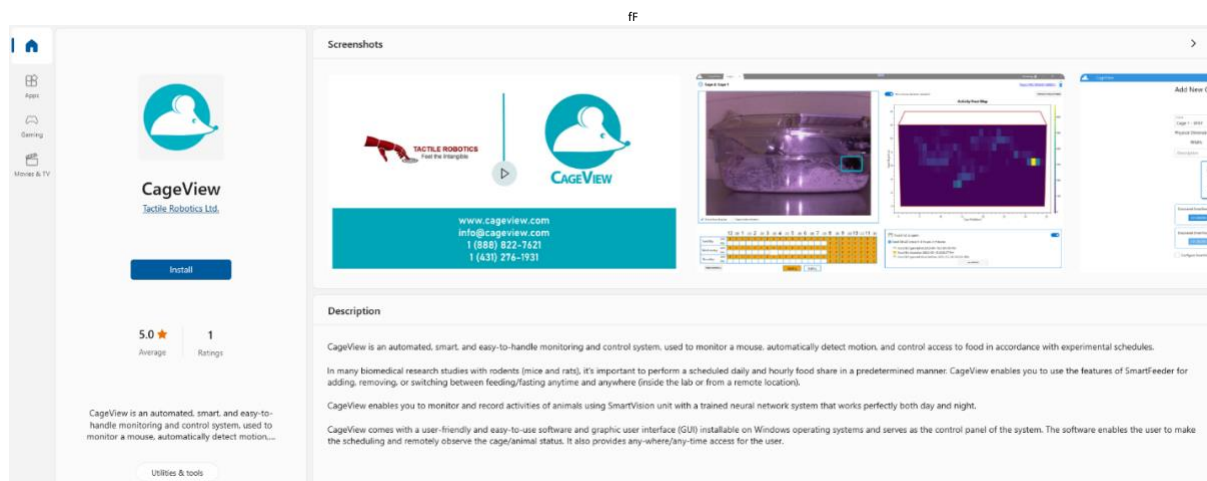

Figure 3. CageView App on Microsoft Store

4. Software Updates

This section provides information about CageView App's software updates and step-by-step instructions for the updating process.

4.1. If the CageView App is outdated, the information button (ⓘ) on the bottom of the main window will blink. Click the information button to see an alert stating, "Updates are available," as shown in **Figure 4.**
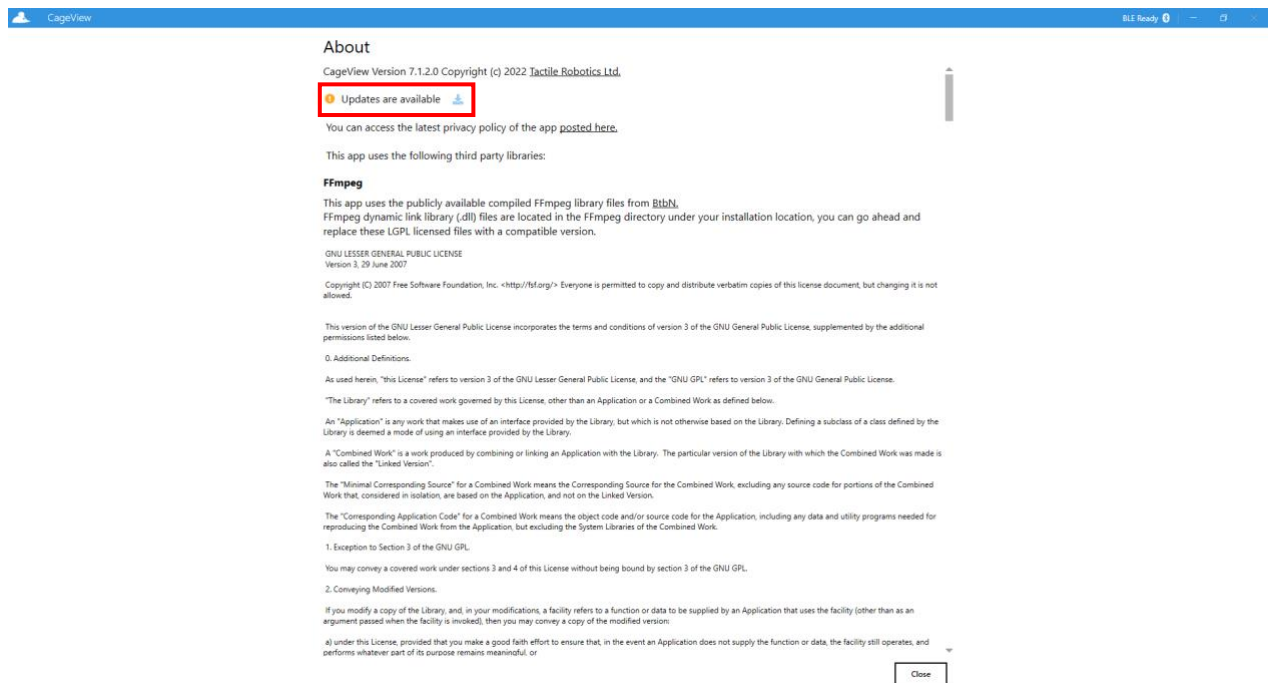

Figure 4. Updates are available warning

4.2. Click the download button beside the "Updates are available" to initiate downloading and installing process (**Figure 5**).

4.3. If the CageView App is up to date, clicking the (ⓘ) button will show information and a statement that the user is using the latest version of the App (**Figure 6**).
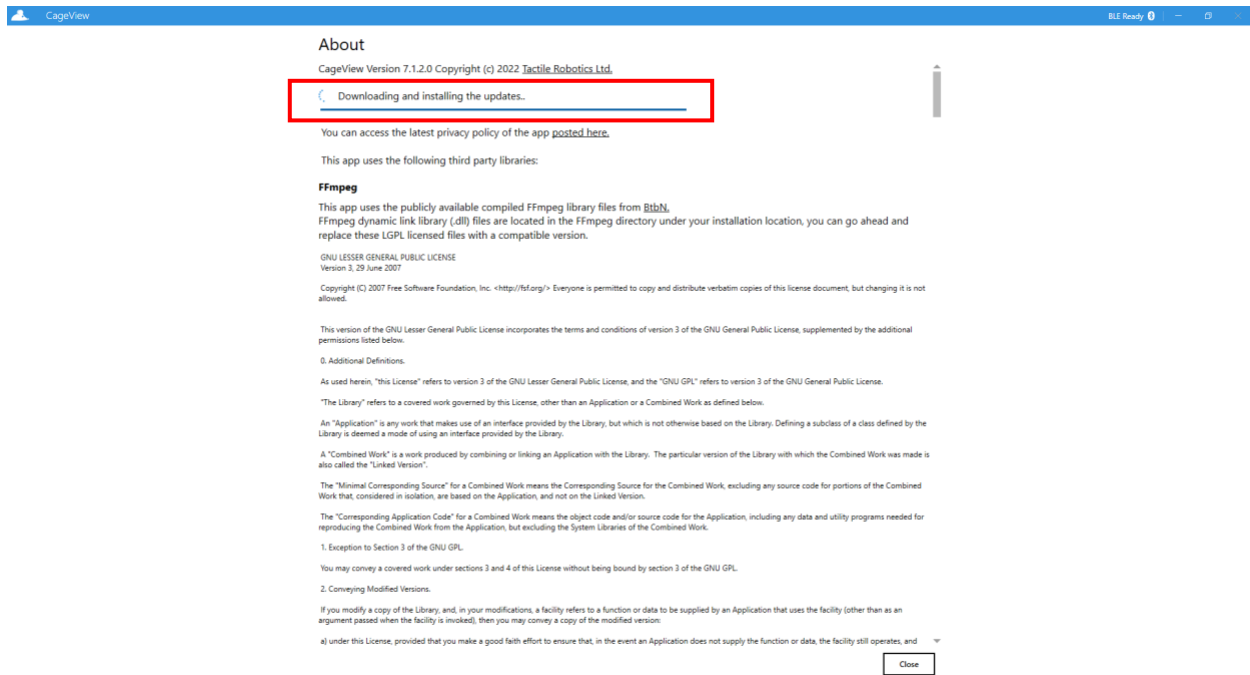
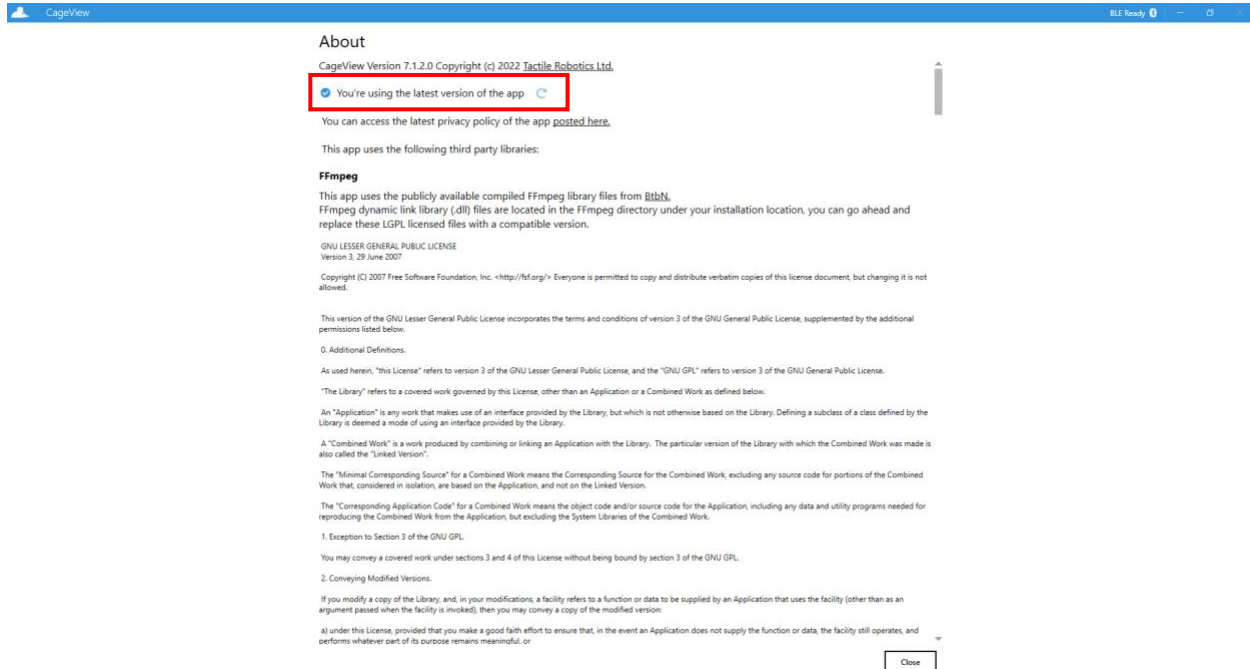**Figure 5. CageView App update downloading and installing**

Figure 6. Using the latest version

5. Software Usage Instruction

This section provides step-by-step instructions on how to work with CageView™ software after it is successfully installed.

5.1. Establishing Wireless Connection

The first step is to establish a wireless connection between Smart Feeder and the software. The following sub-steps explain how to connect the Smart Feeder to the software successfully:

5.1.1. Double-click on the software shortcut located on the Desktop or other location on the machine. The first page of the software is shown in **Figure 7**.

5.1.2. The App indicates Bluetooth Low Energy (BLE) adapter status on its title bar on the right (we'll call this spot BLE status indicator henceforth). The user will see "BLE Ready" when the adapter is enabled and turned on. The user can go ahead and add a BLE CageView and connect to it when seeing this message.

5.1.3. When no BLE adapter is found in the system or disabled under the device manager, the "No BLE Adapter" will appear in the BLE status indicator, as shown in **Figure 8**. The user cannot use the BLE functionality of the App in this state. A restart of the App is required when a BLE adapter is connected or enabled after the App's initial start-up.

5.1.4. The "**Power on BLE**" button is shown in the BLE status indicator area when the BLE adapter is detected, but it is turned off by the system. The user cannot use the BLE functionality of the App when the BLE adapter is off. The user can either click on this button to turn on the BLE adapter or turn it on in Windows settings.

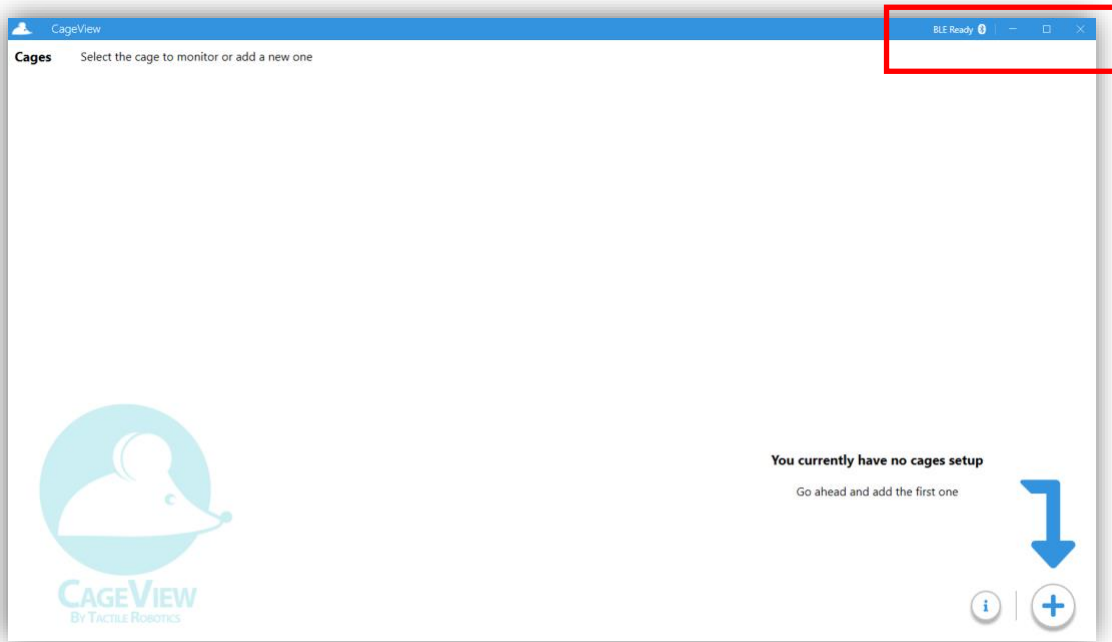**Note:** The App does not require a restart after turning on the BLE adapter **(Figure 9)**.

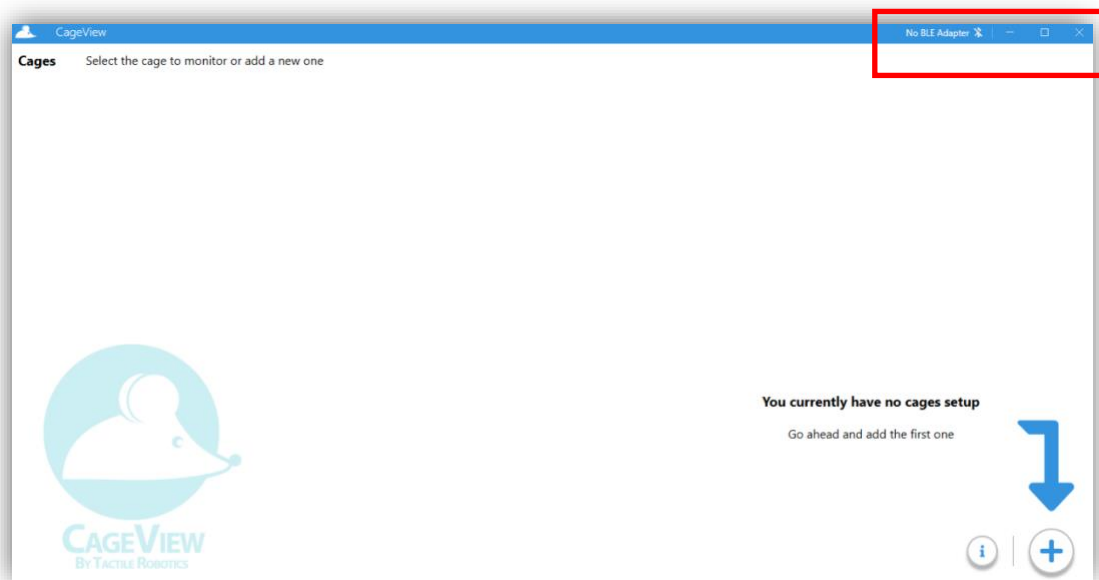**Figure 7. The first page of CageView software**

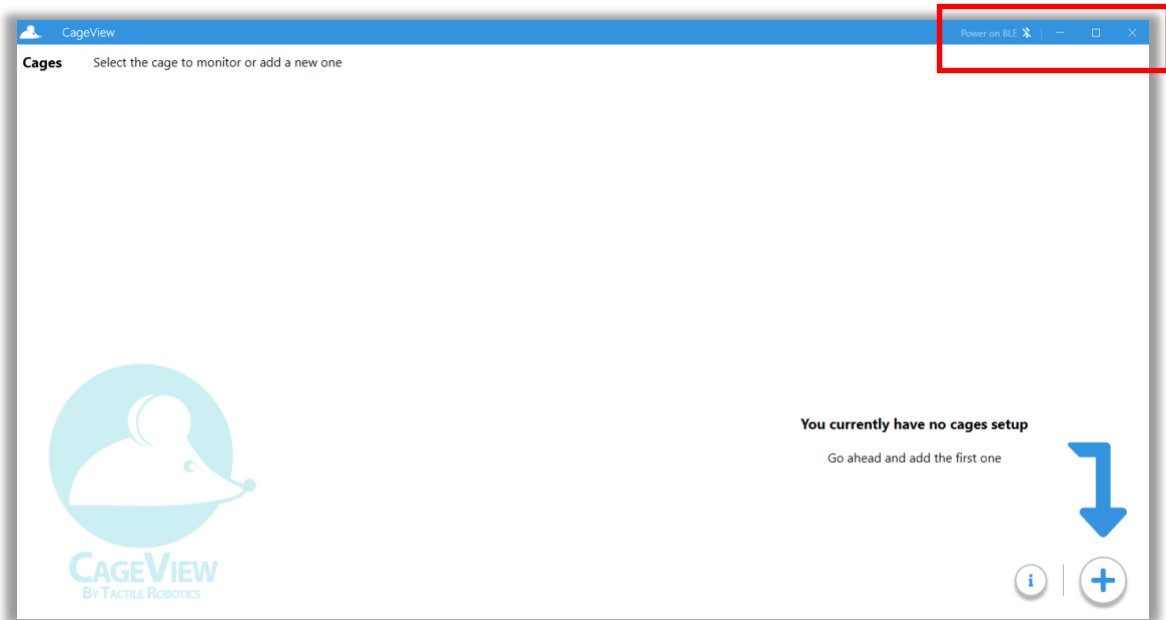**Figure 8. On the first page of CageView software, no BLE adapter**

Figure 9. On the first page of CageView software, Power on the BLE adapter

5.1.5. Clicking on the "**Add Cage**" button (represented by a plus icon) opens the add cage, as shown in **Figure 10**, to add BLE CageView.
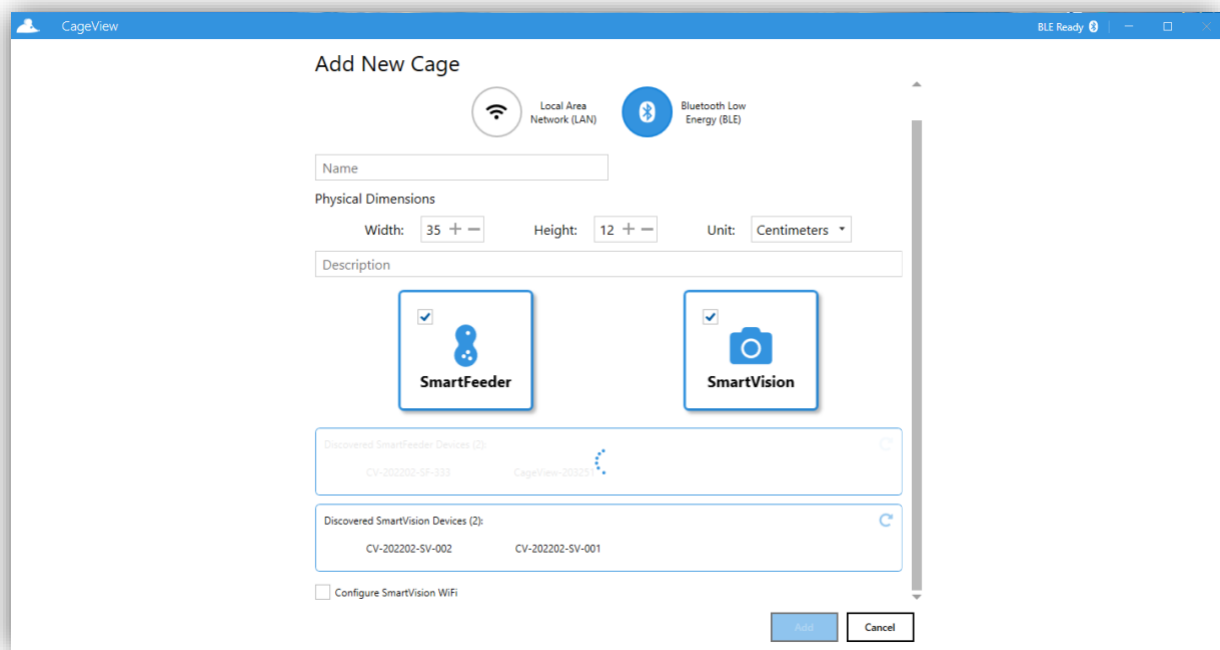

Figure 10. Add a BLE cage – scanning

5.1.6. To add a BLE CageView, choose "**Bluetooth Low Energy (BLE)"** (as shown in **Figure 10**). Ensure the Smart Feeder is on (by clicking the push button). The software starts initiating a BLE scan for nearby CageView. A spinning animation is shown when a BLE scan is in progress.

5.1.7. The user requires to enter a name for each cage added. Filling in the description field is optional and can contain extra information for reference.

5.1.8. The discovered nearby BLE CageView will be listed in the form. The user will need to choose one of the discovered devices from the list in addition to naming it (**Figure 11**). A valid filled form is shown in **Figure 12**.
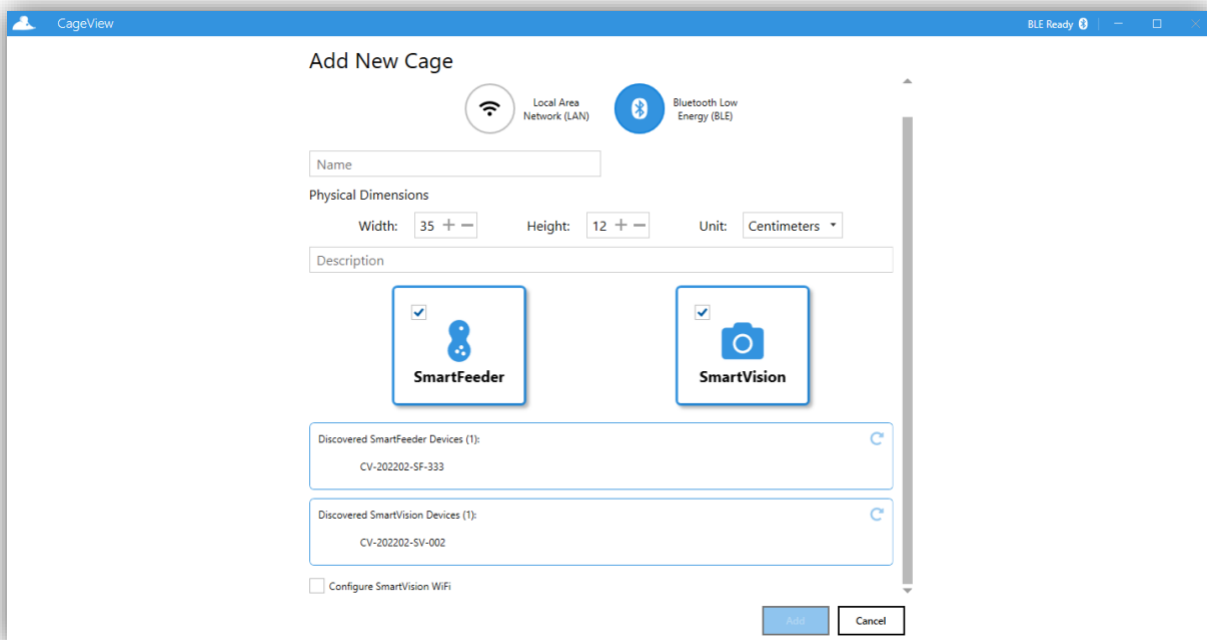

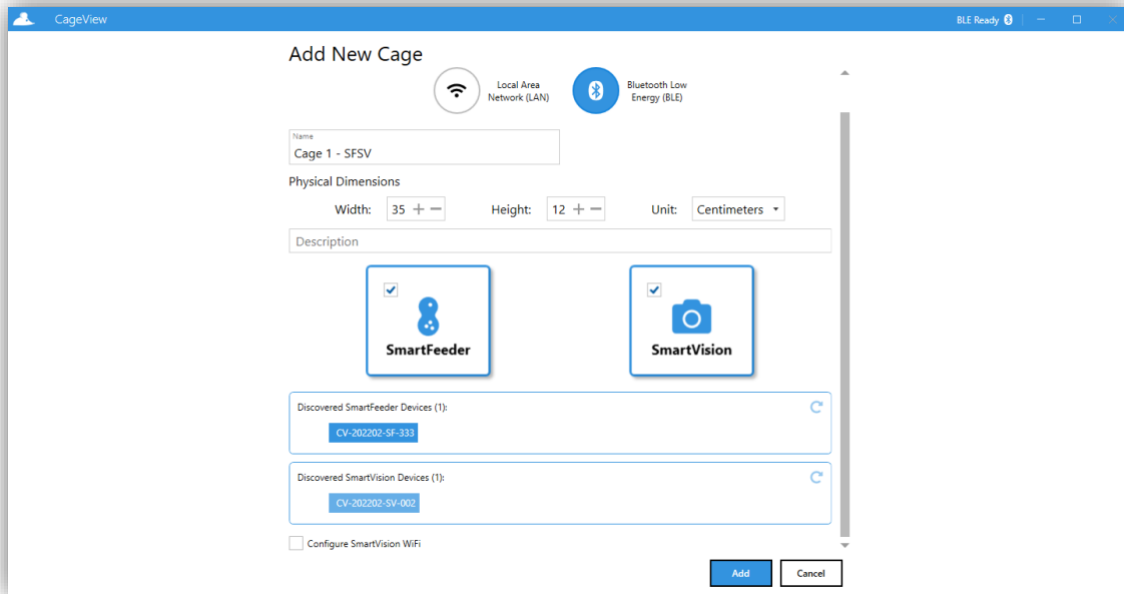**Figure 11. Add a BLE Cage - scan finished**

Figure 12. Add a BLE Cage - filled form

5.1.9. To connect the Smart Vision to the software, ensure the SmartVision is connected to a power source and turned on. Then, click the SmartVision button (represented by a camera icon) and scan for nearby SmartVision devices. Once the scan is finished, nearby SmartVision devices are listed in the form; click the desired SmartVision device and configure the SmartVision WiFi.
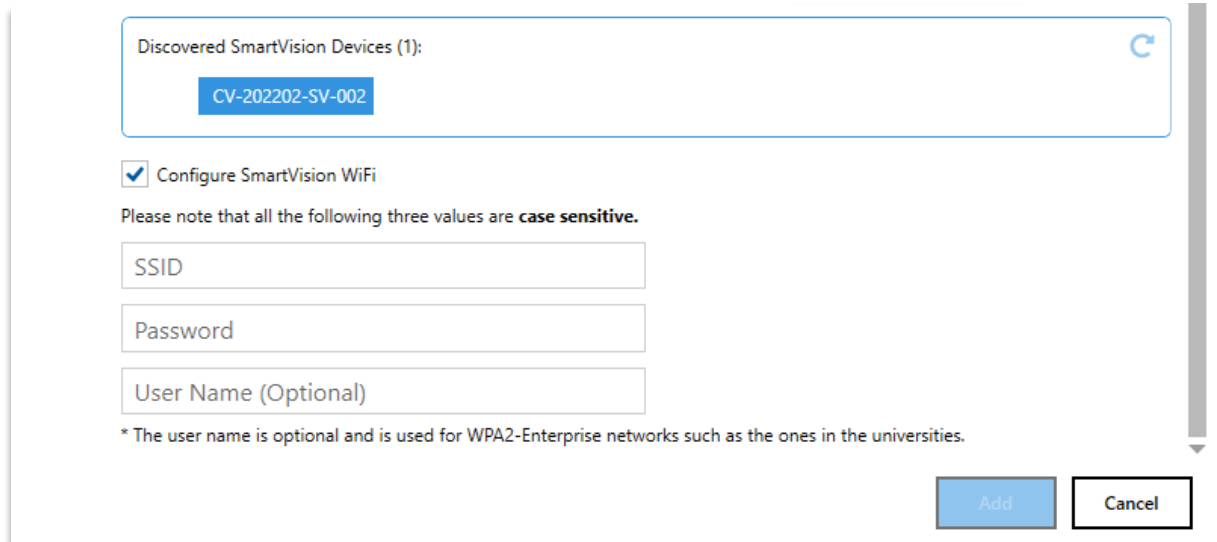
Note: The user can set up the SmartVision and SmartFeeder individually and cannot add a BLE CageView if the "BLE Ready" message is not indicated in the BLE status indicator area.

5.1.10. To configure SmartVision's WiFi connection, choose and click the desired SmartVision device listed on the form after the scanning process. Then, click on the "**Configure SmartVision WiFi**" checkbox.

5.1.11. The user will see an extension of three unfilled values, as shown in **Figure 13**. Fill the boxes for each value with your WiFi information, then click the "**Add**" button.

Note: The SSID and Password are "case-sensitive." Please ensure to type them correctly.

Note: The "Username" box is optional. This is usually used for WPA2-Enterprise networks such as the ones in universities.

Figure 13. SmartVision's WiFi configuration for normal networks

5.1.10. A typical main window after adding one BLE CageView is shown in **Figure 14**. The given name for the cage and its ID in the App can be seen on the top left side. A corresponding icon indicates each cage connection mode on the far right. A Wi-Fi icon indicates a LAN CageView, while a BLE icon indicates a BLE one. Also, notice the set IP for a LAN CageView and the BLE address of a BLE one.

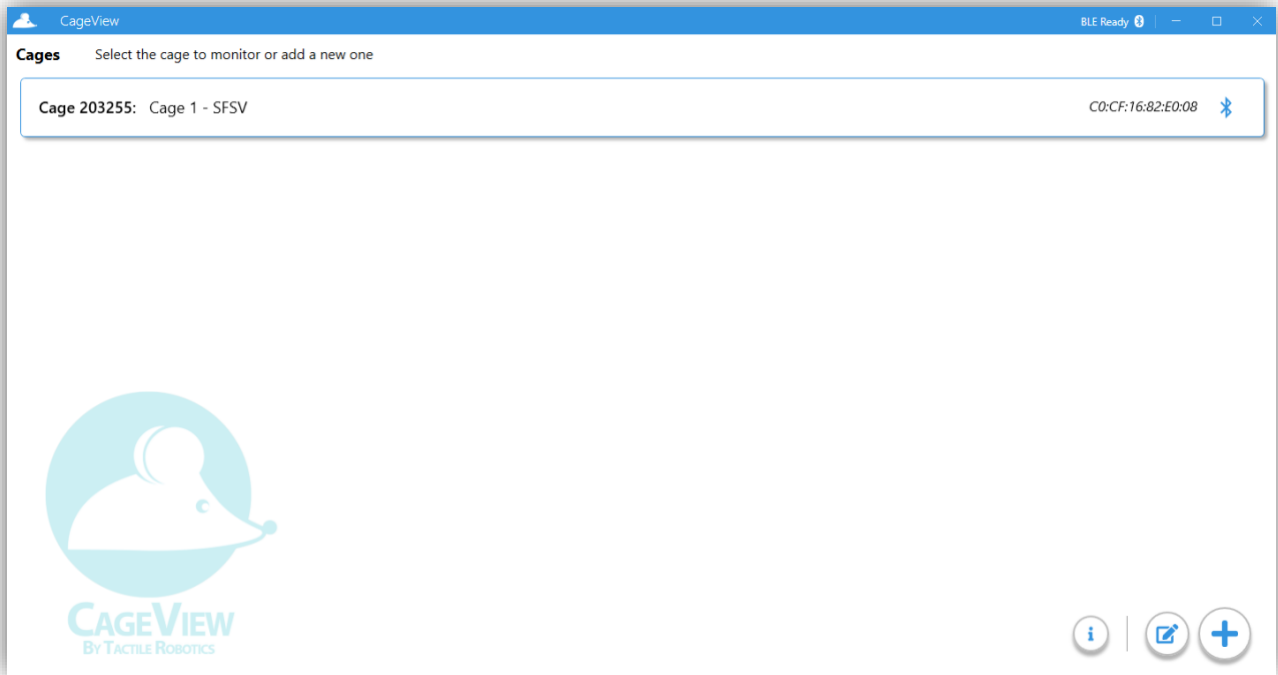**5.1.11.** Click on any CageView item, open the corresponding cage, and initiate the connection, as shown in **Figure 15.**
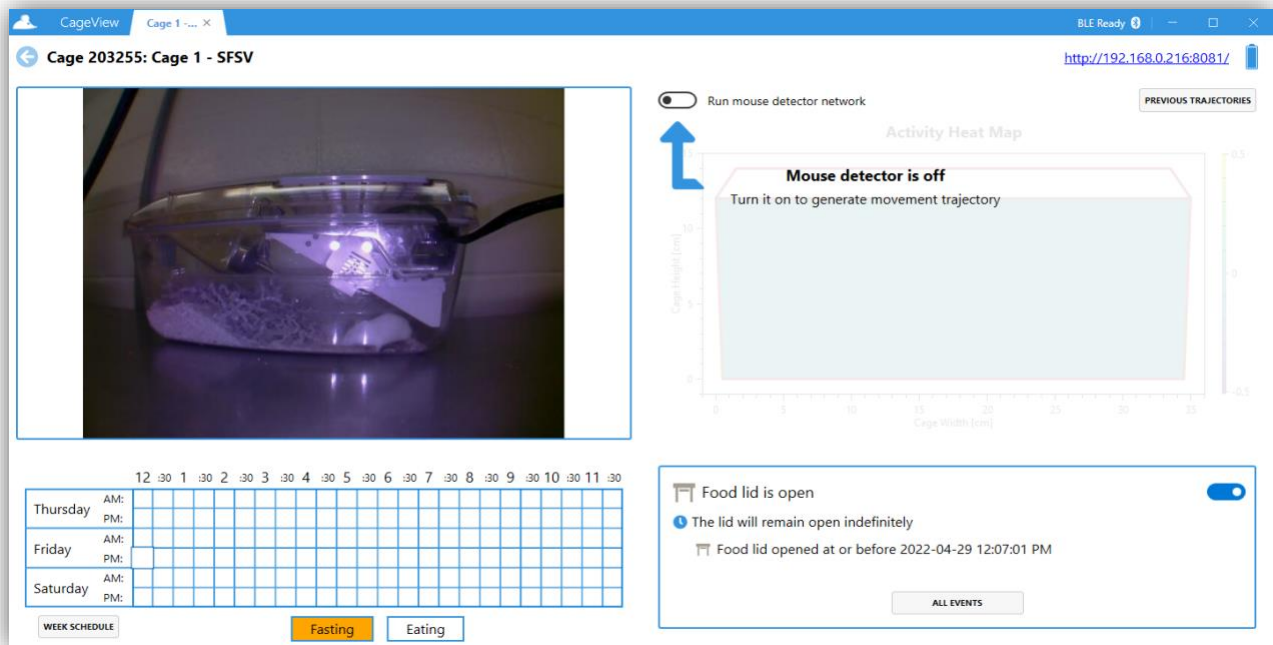
Figure 14. The main window - added the BLE CageView

Figure 15. Opened BLE CageView

5.1.12. The BLE CageView window with only the SmartFeeder connected is shown in **Figure 16**, and **Figure 17** shows a window with only the SmartVision connected.
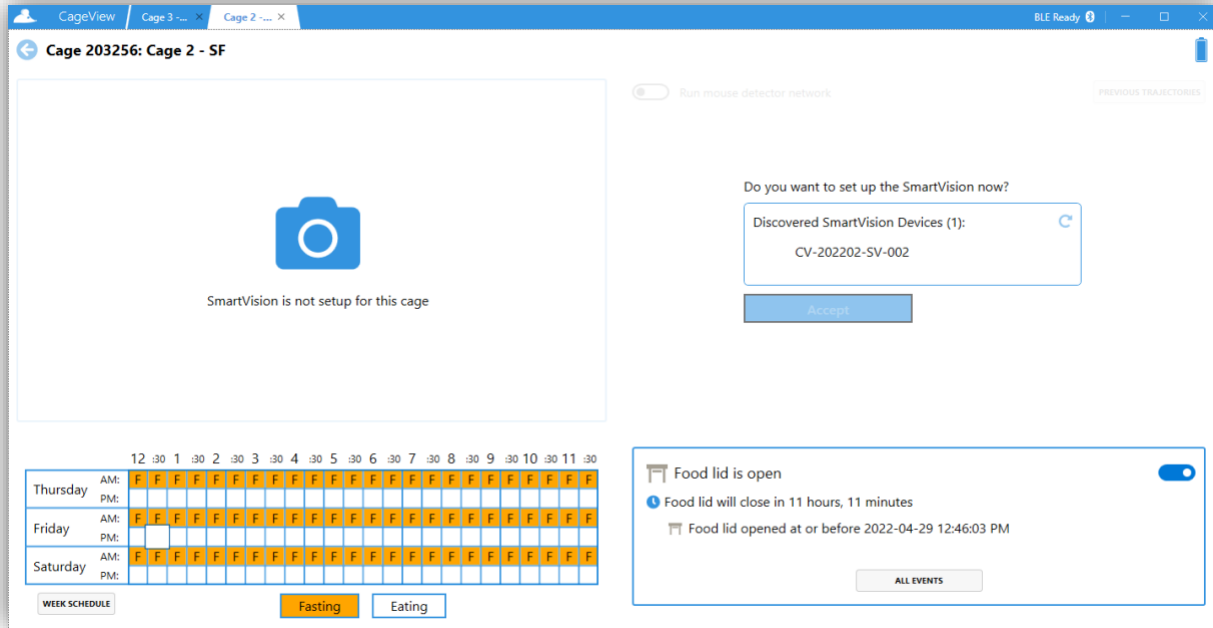

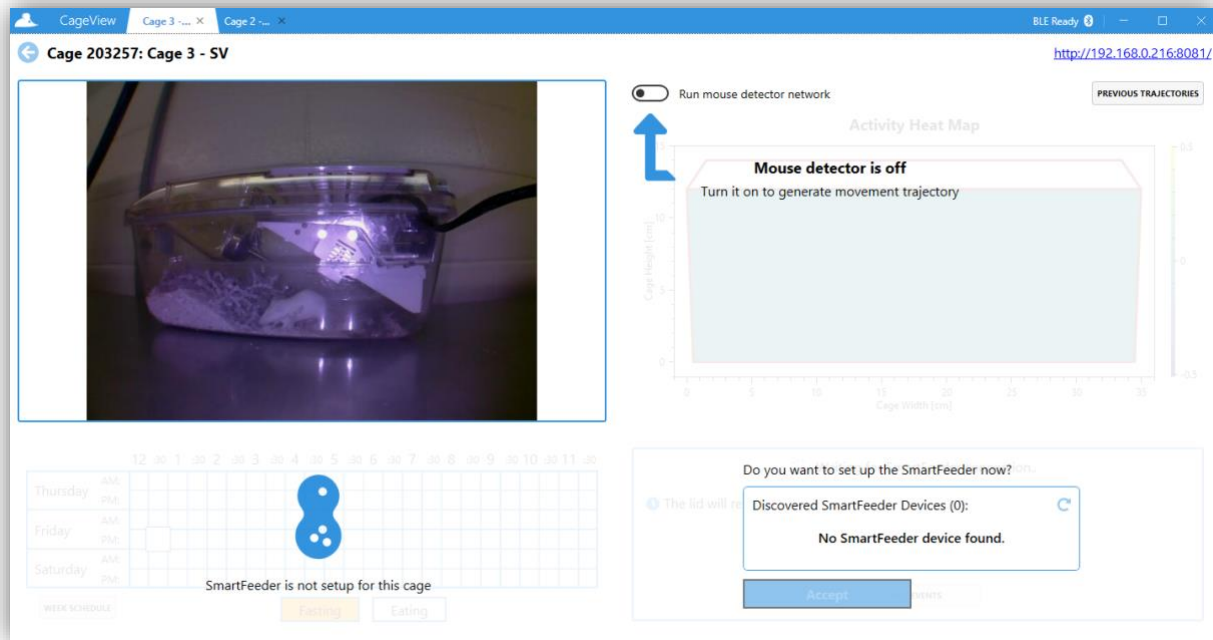Figure 16. Opened BLE CageView, SmartFeeder only

Figure 17. Opened BLE CageView, SmartVision only

5.2. CageView SmartFeeder Feature

This subsection provides useful information on how to use the smart feeder feature of the system. The following sub-steps explain various aspects of the software.

5.2.1. The diet schedule for the cage is shown at the bottom left of the opened cage window. The diet schedule presented is only a focused version that shows the current day in the middle, the previous day, and the day after. The weekly diet is defined by a 48 * 7 schedule, each box representing a 30-minute window during the week. We will name this 30-minute window a time slot from now on.

5.2.2. The time slot corresponding to the current time in the week is differentiated by a breathing animation. Clicking each box toggles the diet for that specific time slot. Then, press down the mouse button and swipe over the desired boxes to change the diet schedule more easily.

5.2.3. The focused schedule after some edits is shown in **Figure 18**. Then, the next upcoming event for the cage is updated accordingly at the bottom right (e.g., "Food lid will close in 11 hours, 45 minutes"). Click the "**Week Schedule**" button at the bottom of the focused diet schedule to open the week schedule dialog.
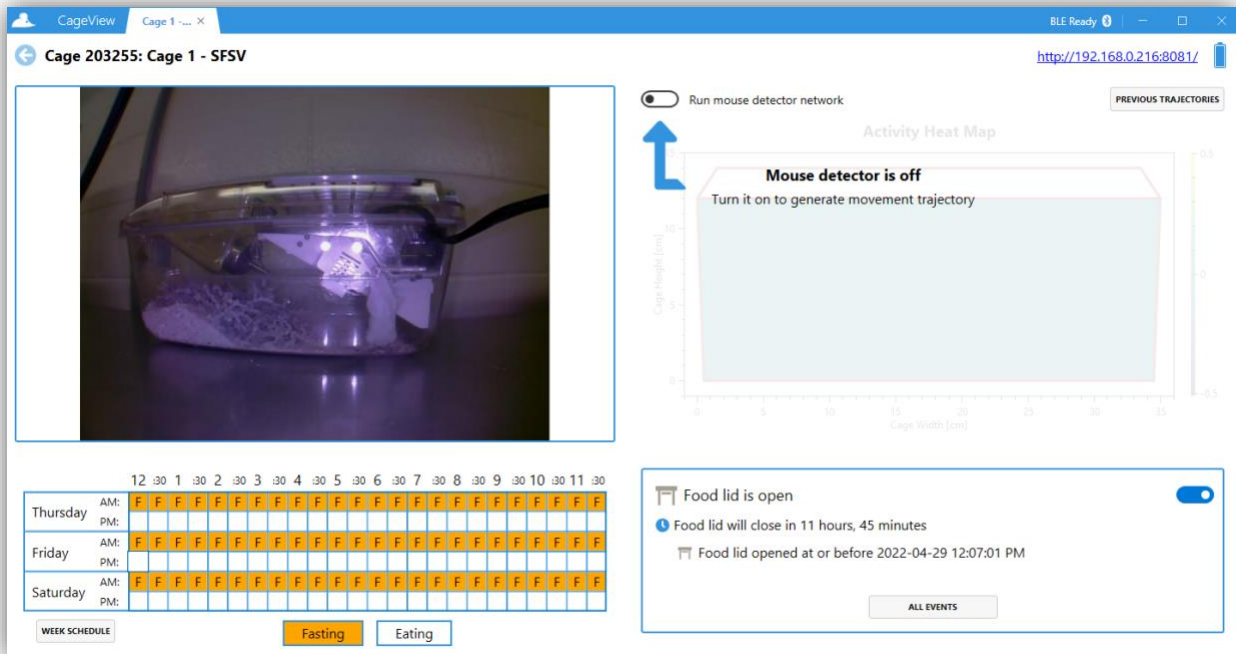

Figure 18. CageView with the diet schedule set

5.2.4. The full weekly diet schedule is presented in the week schedule dialogue, as shown in **Figure 19**. Editing this diet schedule is the same as the focused version. The user can either click on each box individually or press down the mouse button and swipe to change multiple at once. The user can also use this dialogue to save and load their defined diet schedules in the App.

5.2.5. To save the diet schedule, add the name and click the "**Save**" button.

5.2.6. The saved diet schedule's name will be presented by a badge at the top of this dialogue, as shown in **Figure 20.**

Note: The user cannot save the same diet schedule with different names.

5.2.7. After diet schedules are saved in the App, they can be used and loaded onto any CageView that the user wants.

5.2.8. First, the diet from the presented list should be chosen to load a previously saved diet schedule. After selecting a diet schedule from the list, the interface will show a preview (as shown in **Figure 21**) with a different color fading back and forth on top of the current diet schedule to identify the differences and choose the desired schedule more easily.

Note: Please note that editing the diet schedule in this state is disabled, as two diet schedules are presented on top of each other. Click the "**X**" button beside the list to clear your selection and return to your current diet schedule.
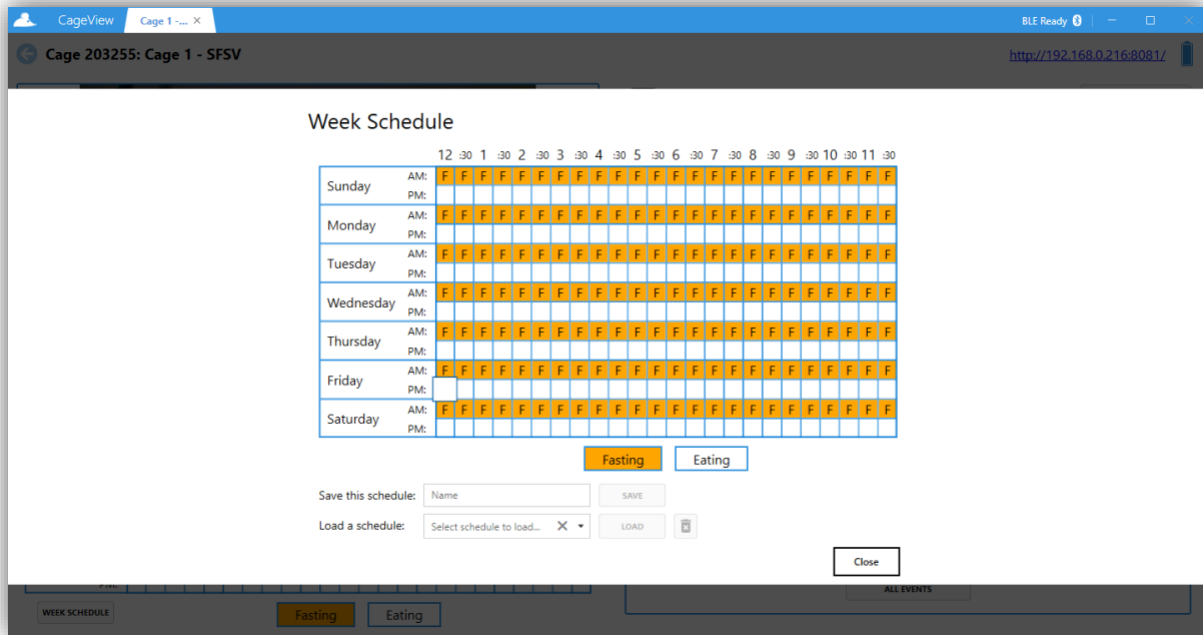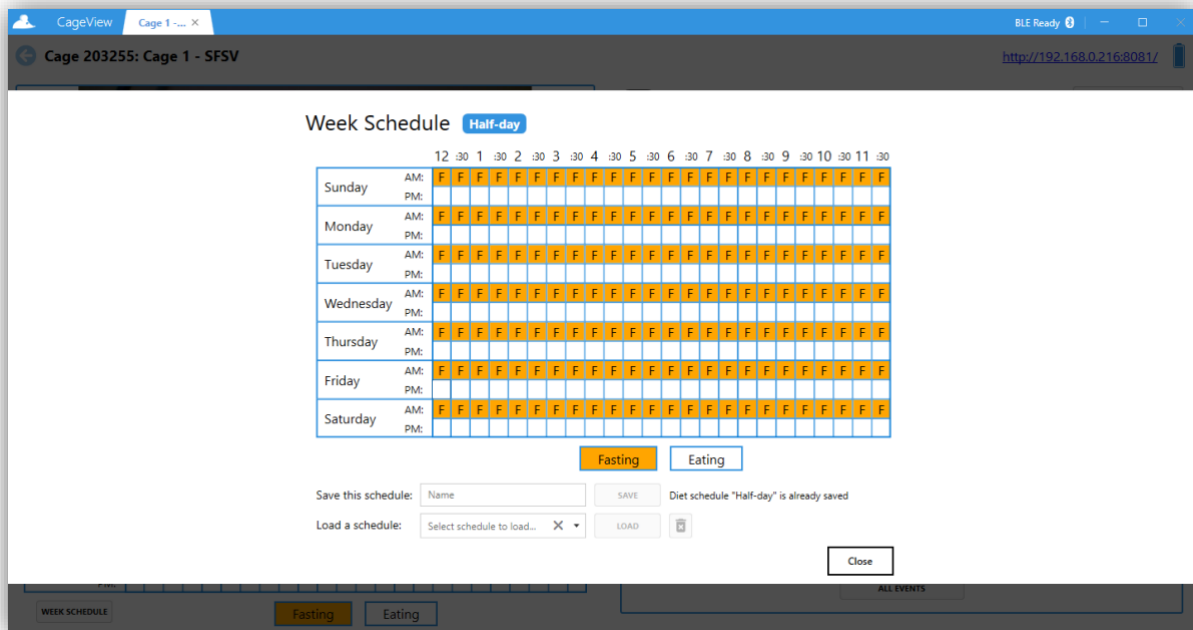

Figure 19. Week schedule dialog

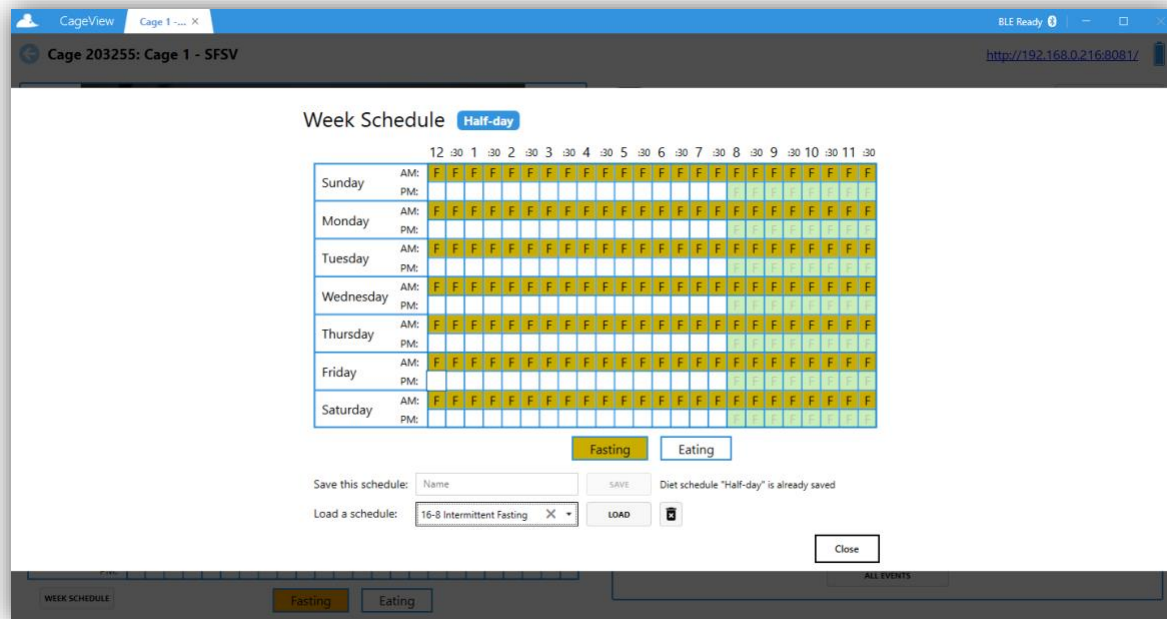**Figure 20. Week schedule dialogue - diet saved**

Figure 21. Week schedule dialogue - load preview

5.2.9. When a diet schedule is selected, the user can either click the "**Load**" button or the "**Delete**" button, represented by a trash bin icon. The result is shown in **Figure 22**.

Note: In addition to setting the desired diet schedule, the user can manually control the cage's current food lid state by using the switch at the right of the cage's view.

5.2.10. The cage's food lid events are logged by the App for reference. A summarized list of these events and the current state of the cage's food lid can be seen. Also, the user can click the "**All Events**" button to see the complete list of food lid events. The dialog for the food lid events history is shown in **Figure 23**.

Note: Each day's food lid events list can be seen here. The events are sorted by their time in descending order, meaning that the most recent one will always be at the top of the list.
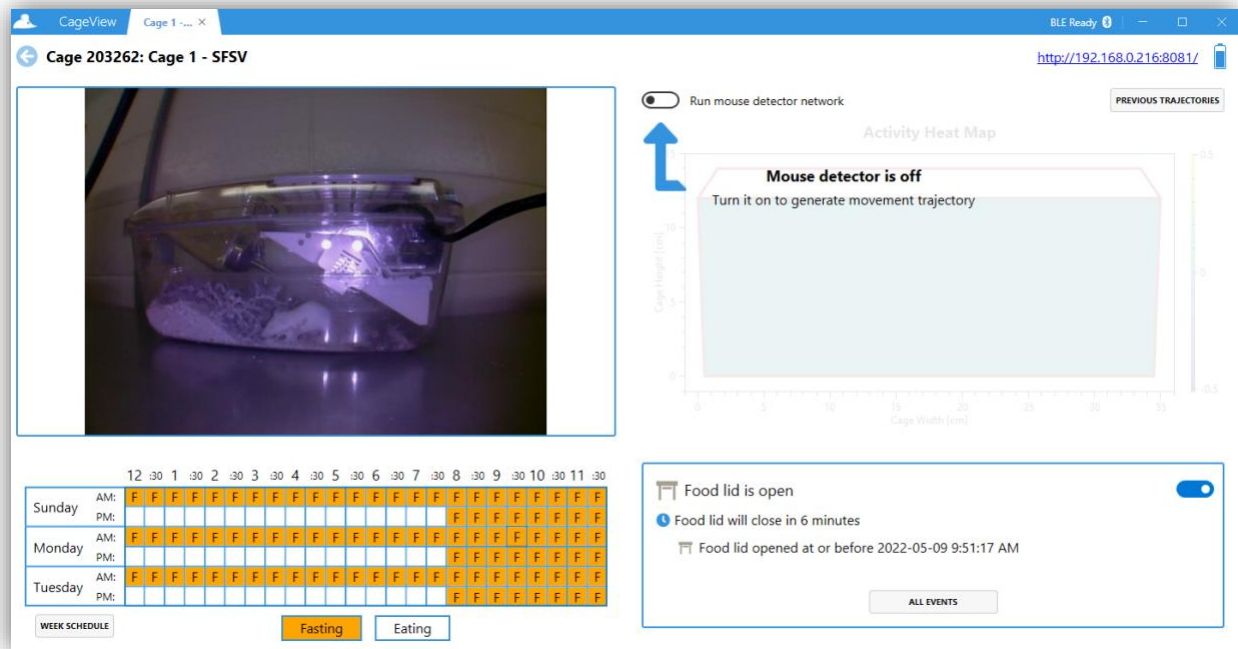
Figure 22. CageView - food lid event added

5.2.11. Choose the log dates, as shown in **Figure 24**. The calendar only shows the dates that the App has records for them. Some days might be crossed with an "**X**" in the calendar, meaning that there are no records for those days in between.
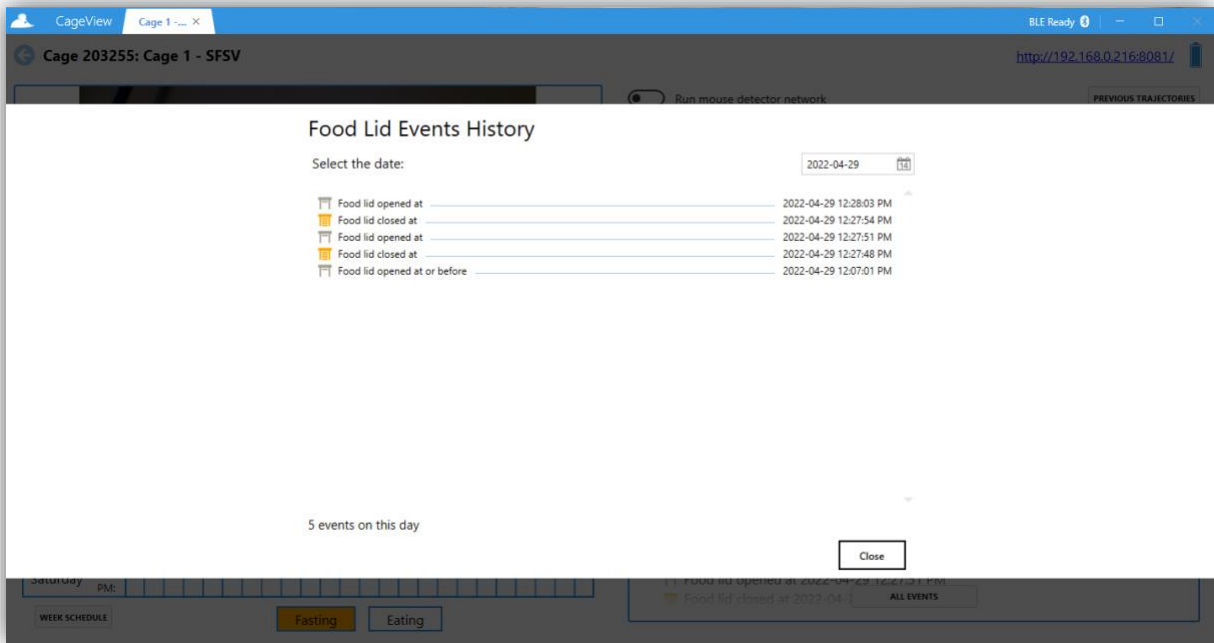
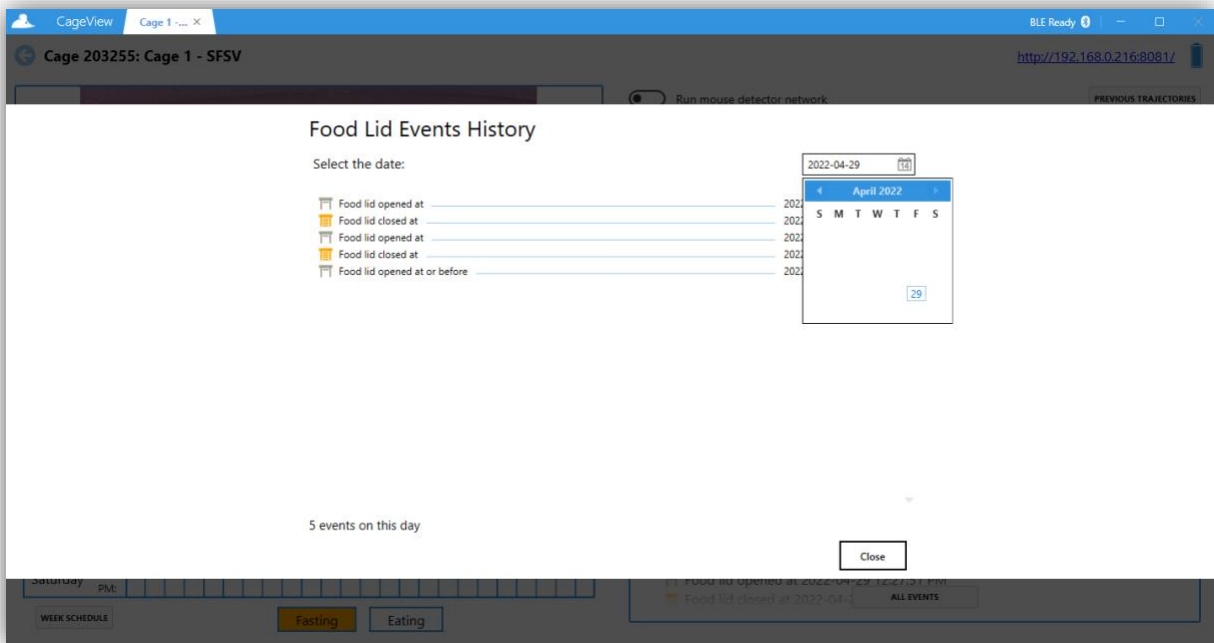**Figure 23. Food lid events history**

Figure 24. Food lid events history - choosing the date

5.3. CageView Activity Monitoring Feature

This subsection provides useful information on how to use the activity control feature of the system. The following sub-steps explain various aspects of the software.

5.3.1. As shown in **Figure 25**, switching the "**Run mouse detector network**" would trigger the mouse detector feature to be executed for each video frame. Having a dedicated GPU installed will significantly improve the performance of this feature execution, as it will be running in real-time for each frame.

5.3.2. After switching the "**Run mouse detector network,**" it is required to adjust the cage's corners to fit with the dimension indicators for the mouse detector reading to accurately pinpoint the mouse's activities, as shown on the heat map.

5.3.3. When the mouse is detected in a frame, its position will be added to the activity heat map. The user can see the current movement trajectory updated in real-time at the top right side of the cage's view.

5.3.4. Switching the "**Run mouse detector network**" off again will cause the current trajectory to be finalized and stored if any detected point exists.

5.3.5. Clicking the "**Previous Trajectories**" button will show the history of previously gathered mouse movement trajectories. The dialog presenting the trajectory logs history is shown in **Figure 26**. The previously stored trajectories can be chosen from the list at the top. Each trajectory log is presented by its date, duration, and count of points. If required, the metrics can be exported into *.csv* formats.
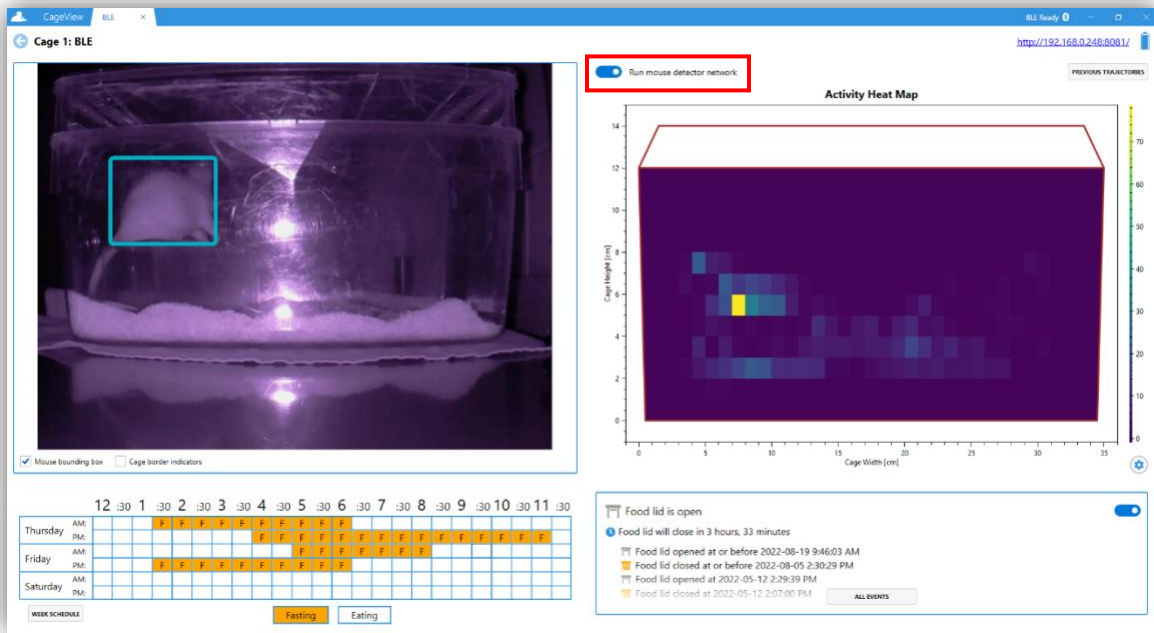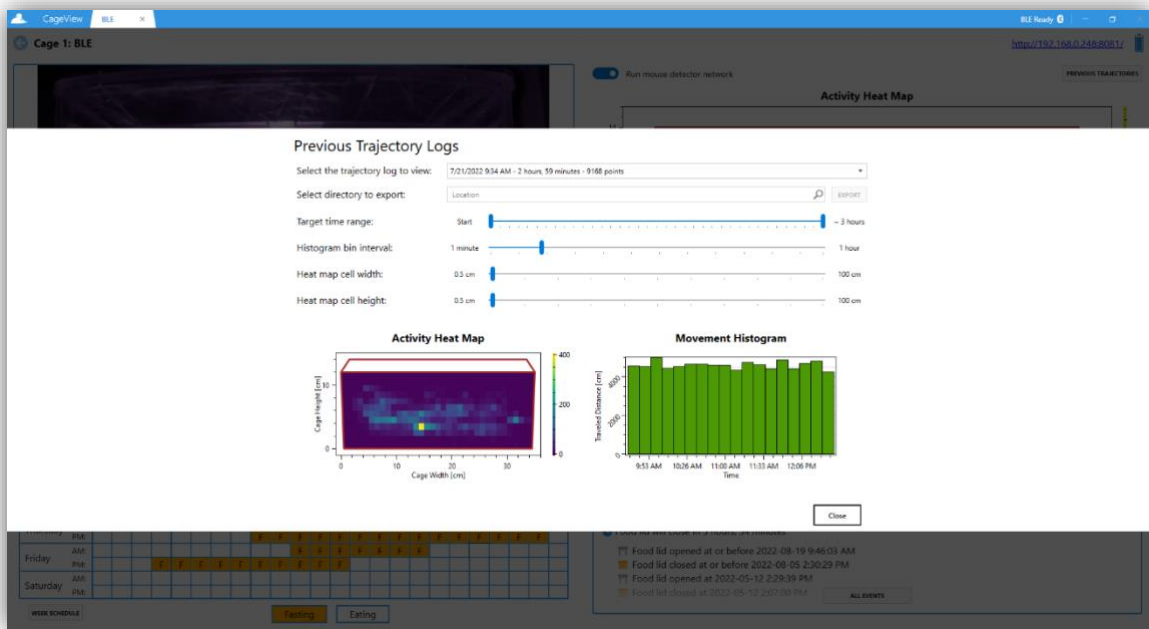
Figure 25. CageView - Run mouse detector network

Figure 26. Trajectory logs history

Note: Since the BLE CageView can function independently without the App, some food lid events might be a rough estimate, as the App cannot gather all the logs when not connected to the cage. Every time the cage's current state differs from the last stored food lid event, an estimated food lid event will be generated, stating that the food lid event was opened\closed at or before a certain time.

5.3.6. Since the BLE CageView can function stand-alone without the App, it requires a correct time and the diet schedule to be set on the board. The dialog shown in **Figure 27** will only pop up when the system time the App is running differs from the time set on the BLE CageView.

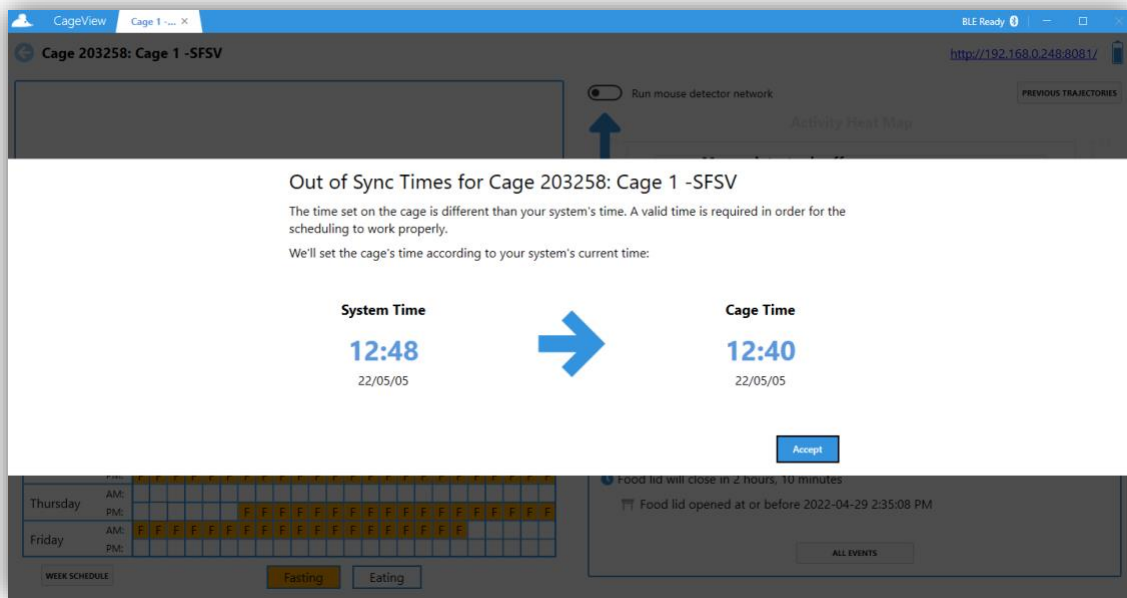**Note:** It is usually a good idea to check if the system time is correct when this dialog is shown.

Figure 27. CageView - Out of sync times

Note: If the system time is correct, accept the dialog, so the system time is written to the BLE CageView.

5.3.7. The dialogue shown in **Figure 28** will only pop up when there is a conflict between the diet schedule set in the App and the one set on the BLE CageView's board. Two options are provided to keep the App's diet schedule version ("**Keep App**" button) or to keep the one set on the board ("**Keep Cage**" button).
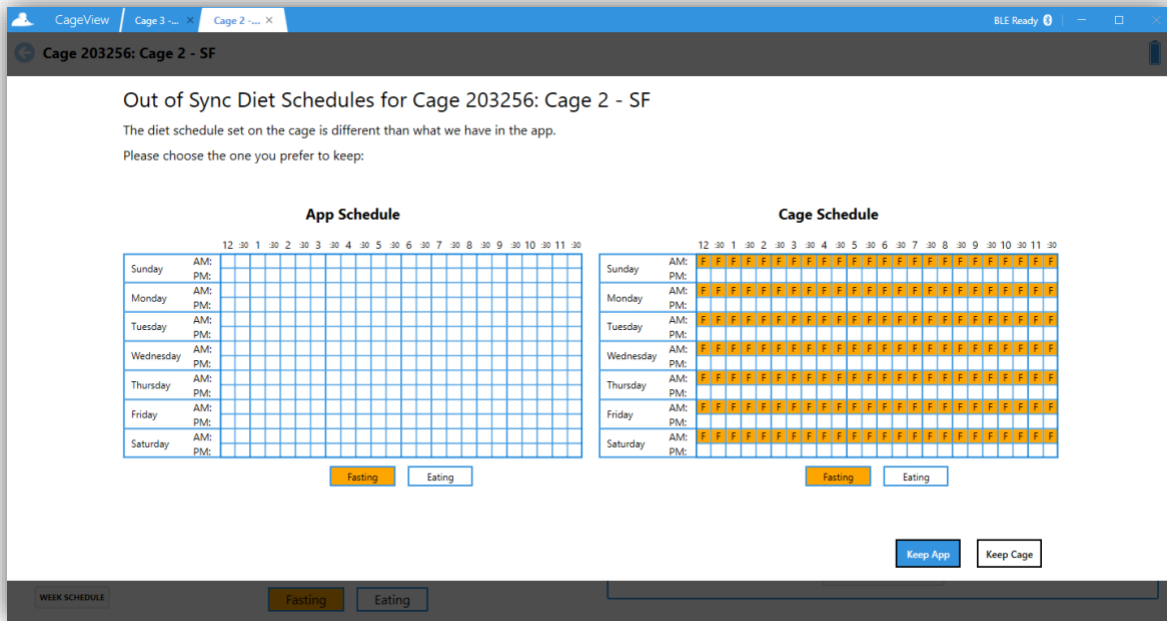

Figure 28. CageView – Out-of-sync diet schedules

5.3.8. The App's main window is shown in **Figure 29**. Click the "**Edit Cages**" button presented by a pencil icon to turn on the editing mode.
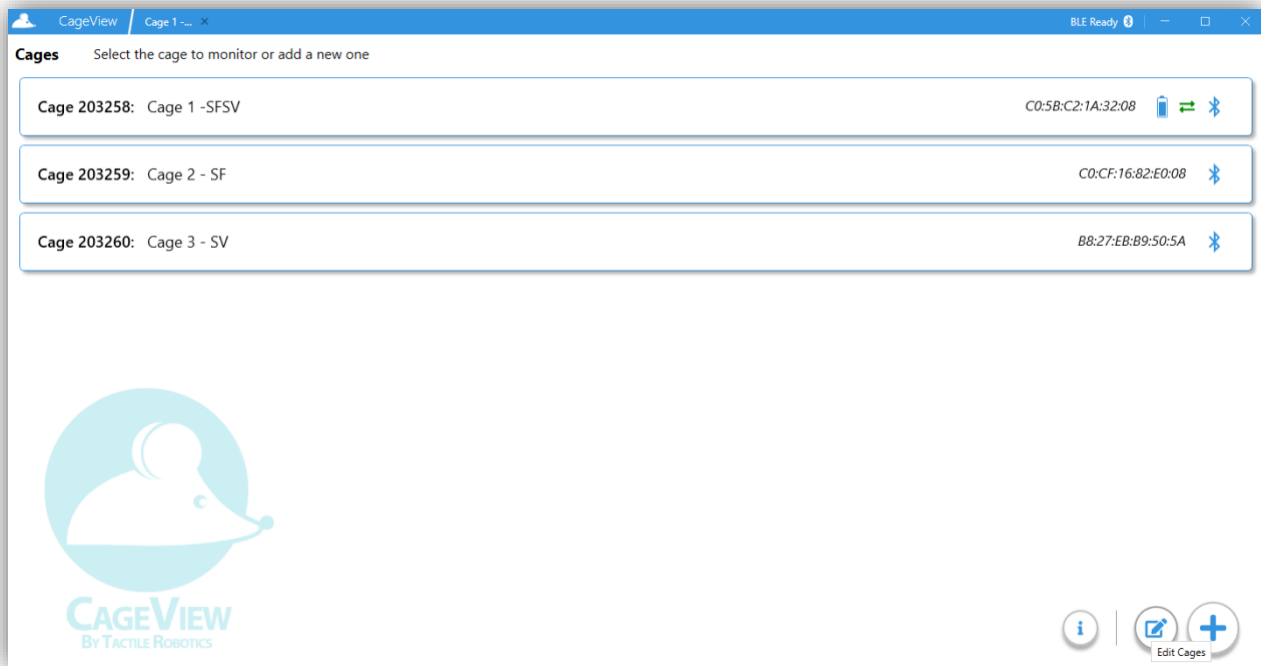
Figure 29. Editing CageViews

5.3.9. As shown in **Figure 30**, the CageView items in the list will become selectable in the editing mode and clicking on each CageView will select that item instead of opening it. The selected CageViews are indicated and presented differently.

- The user can delete the CageViews that are no longer needed by clicking on the "**Delete**" button presented by a trash bin icon. Deleting the CageView will also delete all the gathered history.
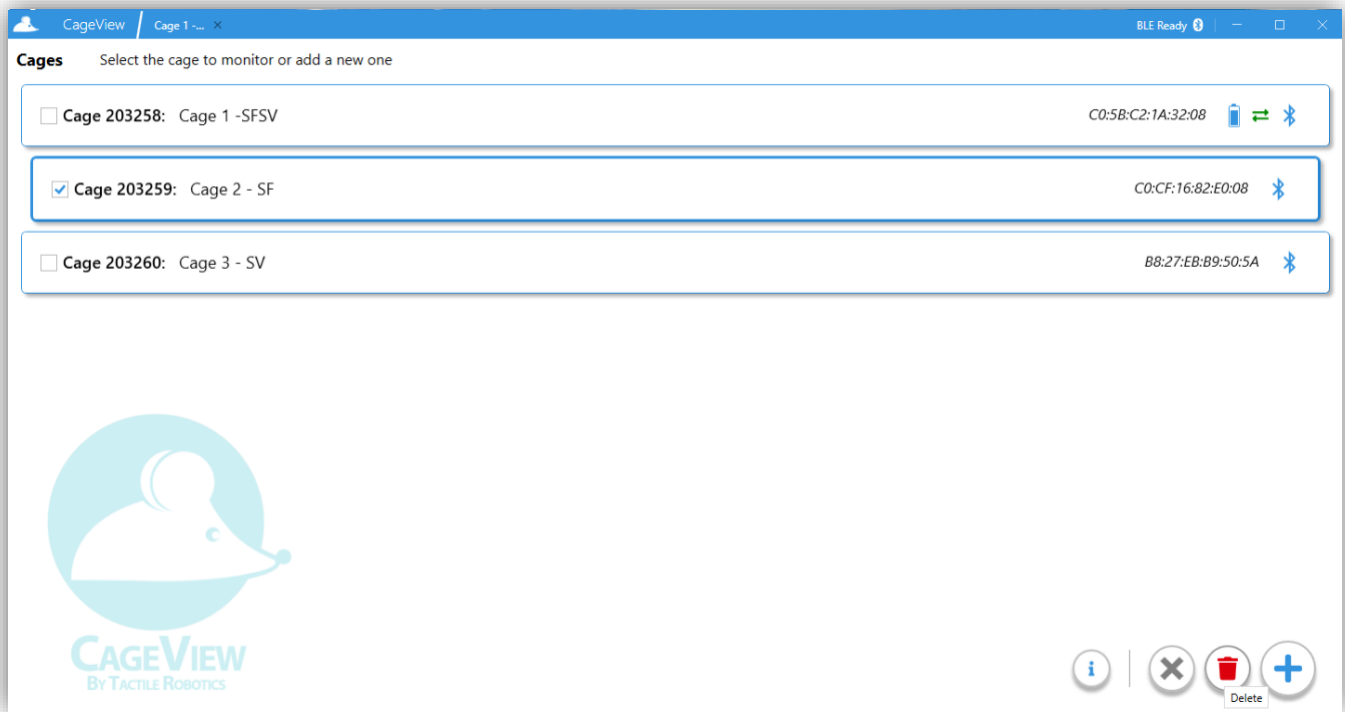- The user can discard editing by clicking the "**Cancel**" button presented by an "**X.**"

Figure 30. Editing mode - CageView selected

6. Connecting CageView Devices to an Existing CageView

This section provides step-by-step instructions on how to connect the CageView devices, such as the SmartVision and the SmartFeeder, to an existing CageView.

6.1. Connecting SmartVision Device to an Existing CageView

6.1.1. To connect SmartVision to an existing cage, click the scan button and select your desired SmartVision device. Click the "**Accept**" button afterward (**Figure 31**)**.**

- The user does not need to input the SSID/password/Username for this process if the SmartVision is previously configured. If not, a window will pop up and ask for entering credentials to configure the WiFi connection on the SmartVision device. Ensure the SmartVision is turned on before scanning.

6.2. Connecting SmartFeeder Device to an Existing CageView

6.2.1 When connecting the SmartFeeder to an existing cage, click the scan button and select your desired SmartFeeder device. Click the "**Accept**" button afterward (**Figure 32**).
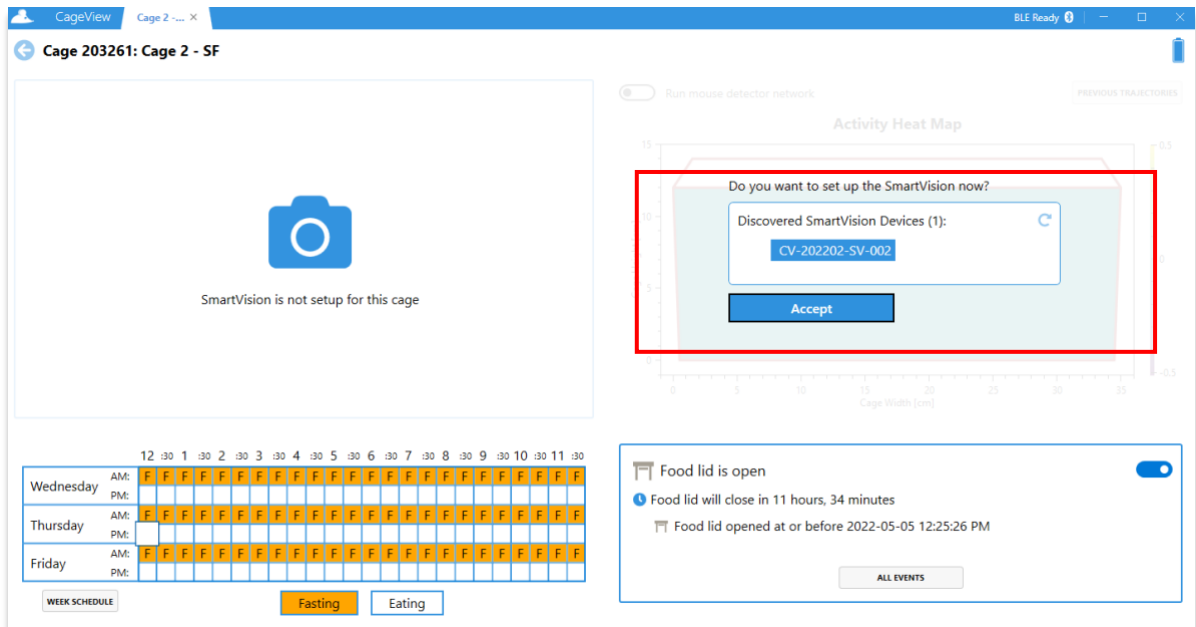

Figure 31. Connecting SmartVision device to an existing CageView
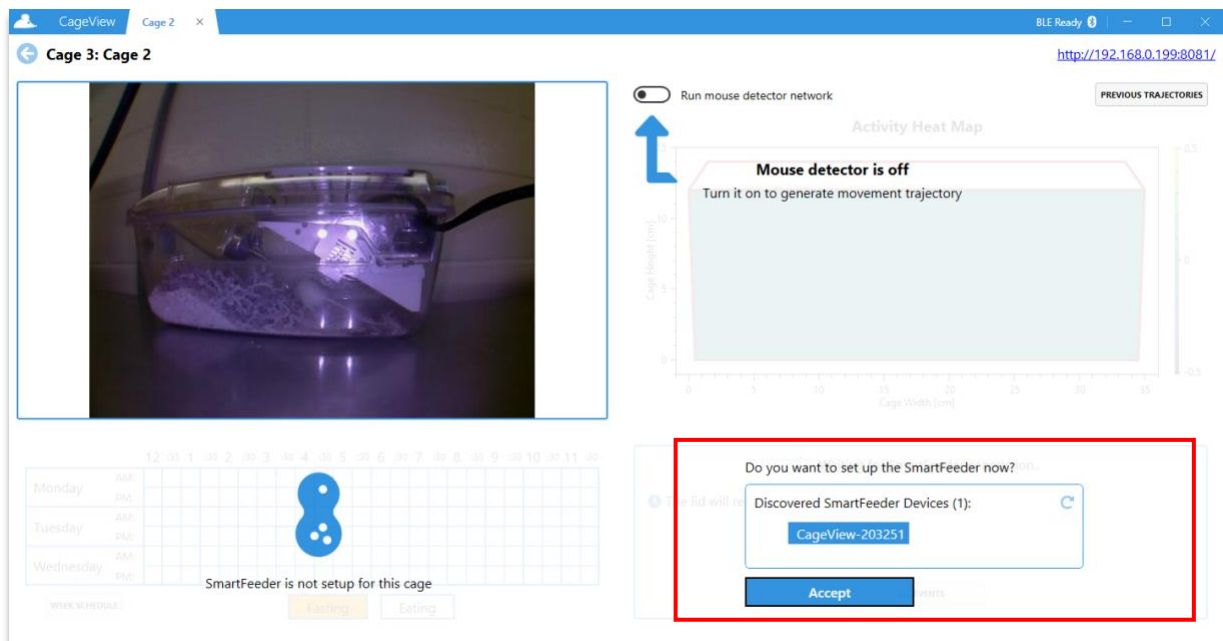

Figure 32. Connecting the SmartFeeder device to an existing CageView

7. Customizing and Exporting Trajectory Data Into .csv Format

This section provides step-by-step instructions on how to report trajectory data from the SmartVision feature and export it in *.csv* format.

7.1. Selecting Trajectory Log

7.1.1. Click the "**Previous Trajectories**" Button to open the Previous Trajectories Log dialog.

7.1.2. Select the desired trajectory log to view, as shown in **Figure 33**, and the user should see the recorded visual of the activity heat map and movement histogram.
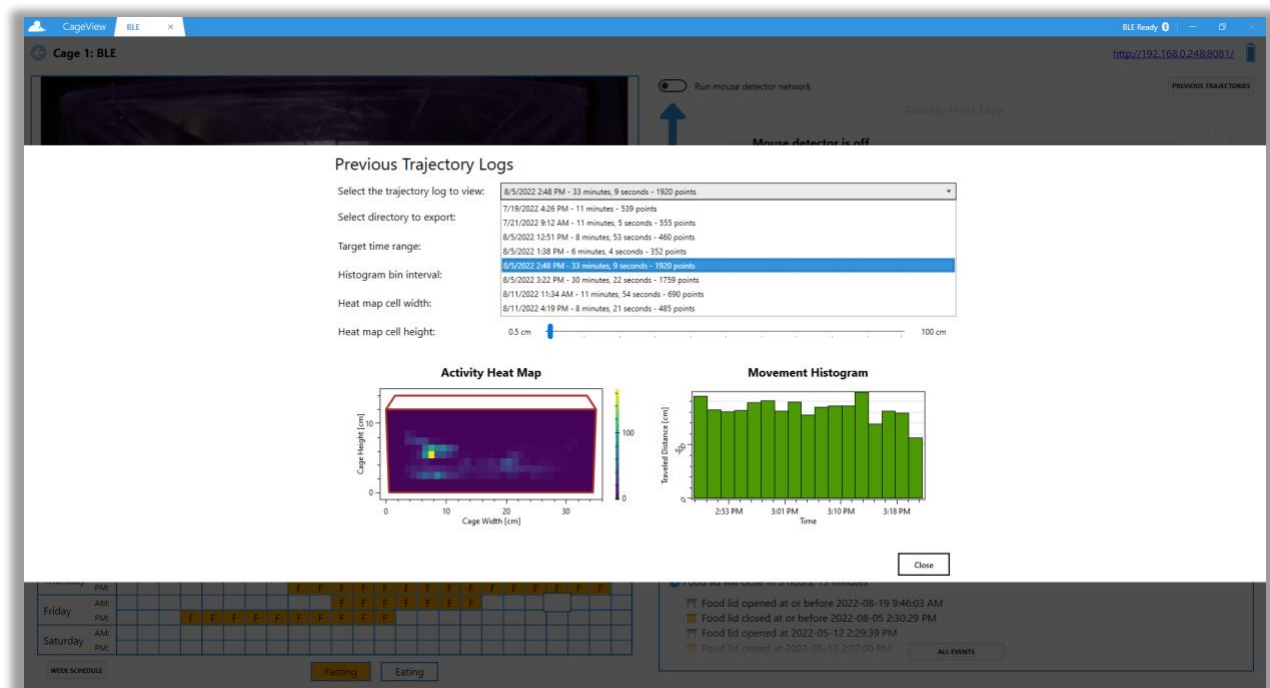

Figure 33. Selecting trajectory log to view

7.2. Customizing Target Time Range

7.2.1. To customize the target time range, drag the slider to set the preferred time range, as shown in **Figure 34**.
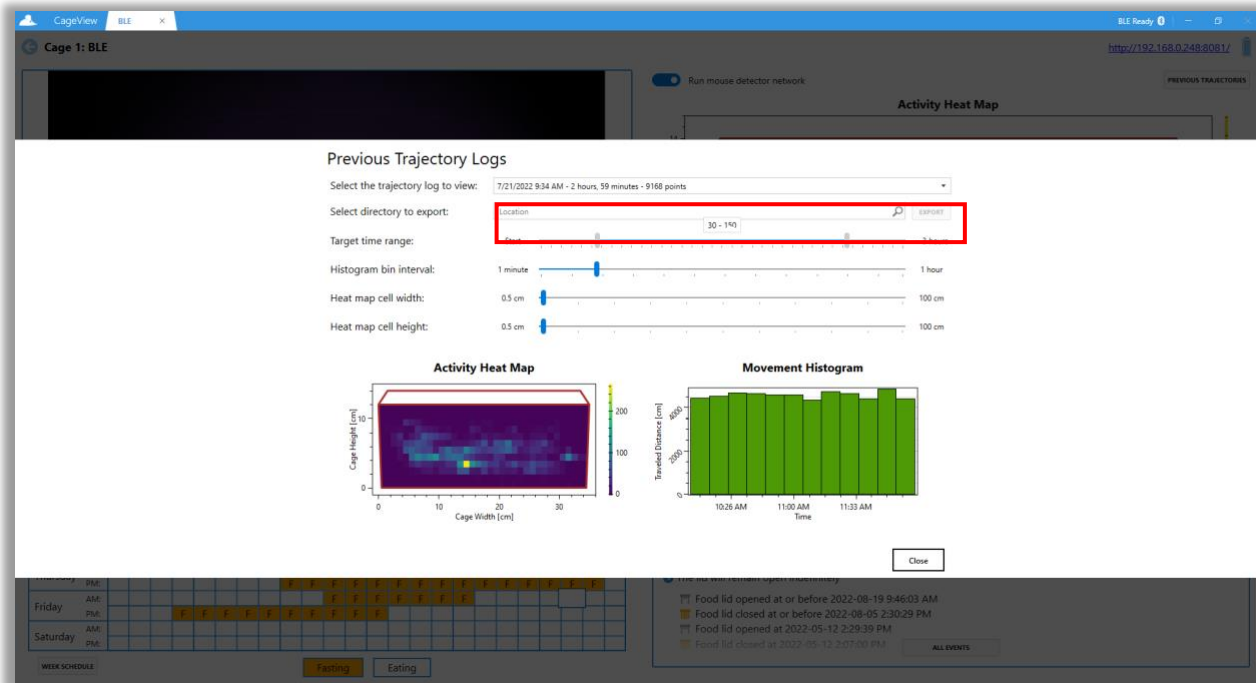

Figure 34. Customizing time range

7.3. Customizing Histogram Bin Interval

7.3.1. To customize the histogram bin interval range, drag the slider to set the preferred time bin, and the user should see a difference in data distribution on the movement histogram (**Figure 35**).

Note: The user can customize the histogram interval with various excrements of time, e.g., 10 minutes, 20 minutes, 30 minutes, 1 hour etc. The differences in chosen time excrements can be seen on the movement histogram.
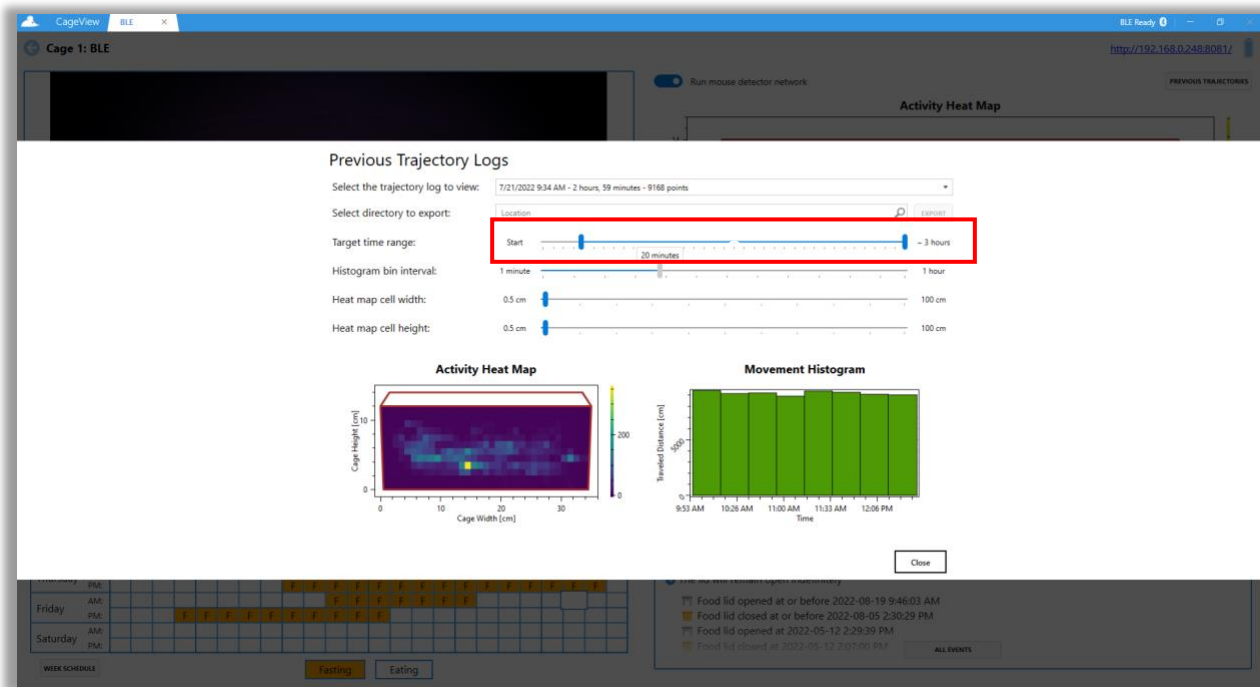
Figure 35. Customizing histogram bin interval

7.4. Customizing Heat Map Size

7.4.1. Drag the sliders for the cell width and height to customize the heat map cell size to set the desired size range. The user should see a difference in cell size on the heat map. This feature allows the user to limit the range and focus on a specific cage for closer observation (**Figure 36**).

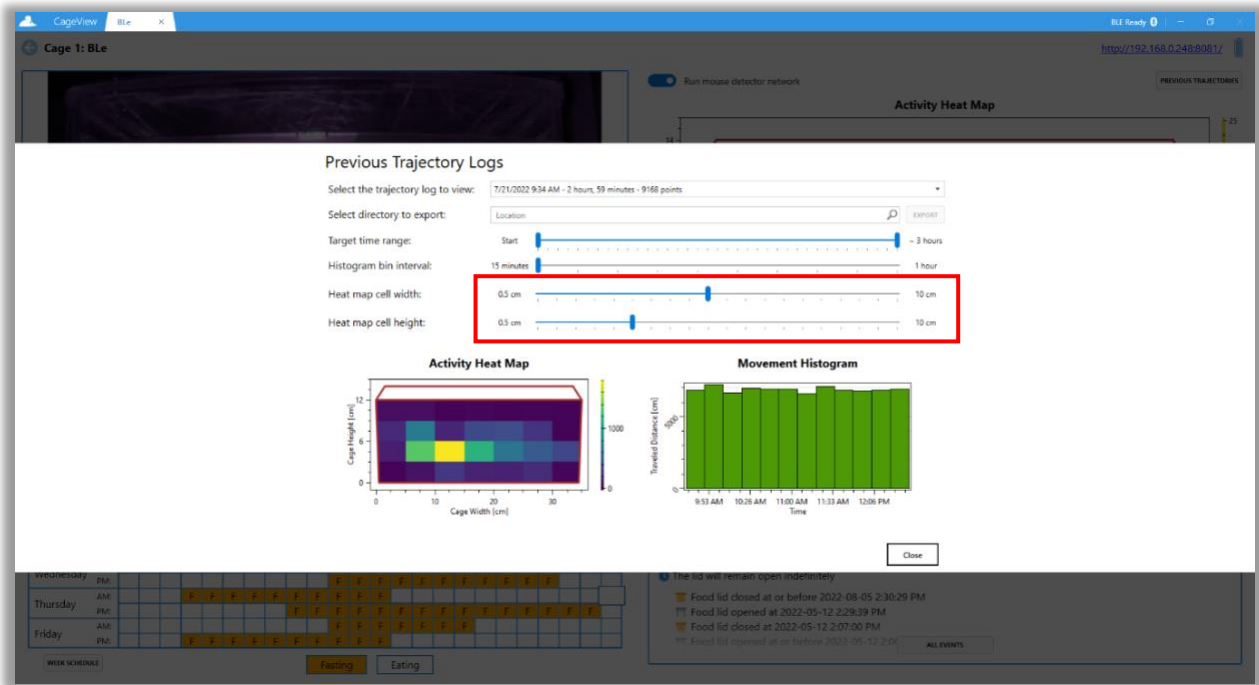**Note:** The user can also customize the heat map size on the BLE CageView window (**Figure 37**).
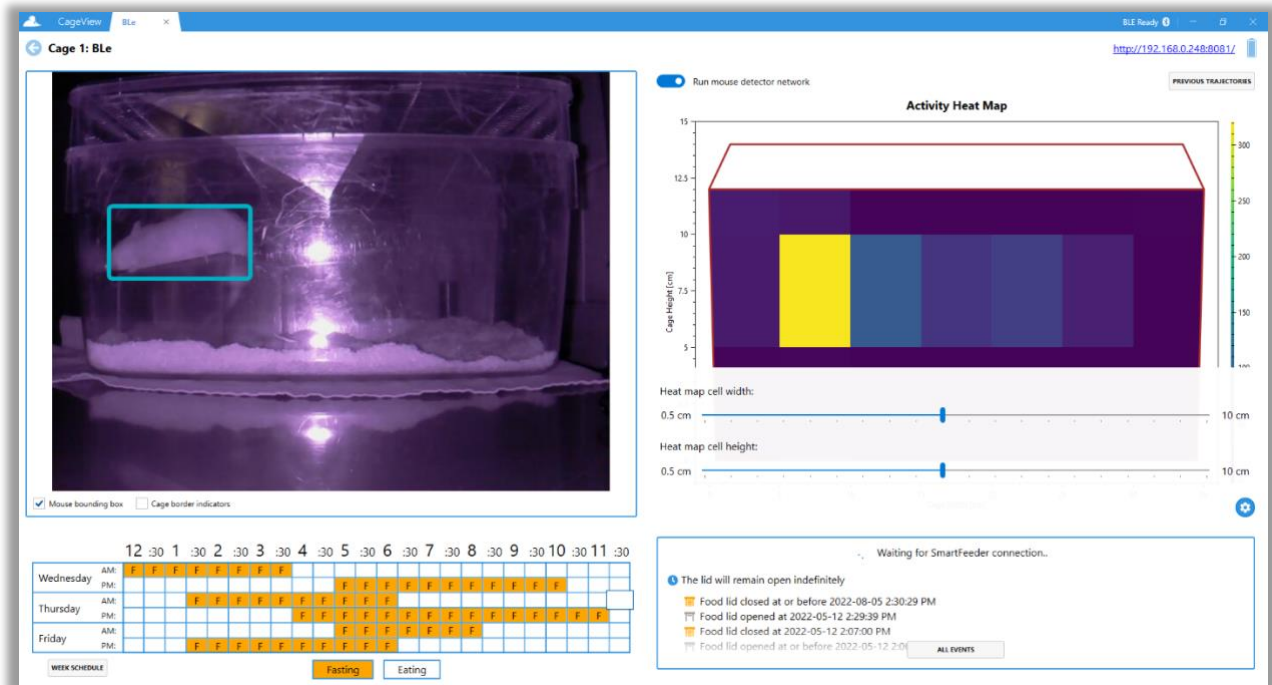
Figure 36. Customizing heat map size

Figure 37. Customizing heat map size on the BLE CageView window

7.5. Exporting Trajectory Data

7.5.1. Once trajectory data has been customized, exporting the *.csv* and plot images can begin.

7.5.2. Click on the magnifier glass icon and select the folder to export the trajectory log-in, as shown in **Figure 38**.

7.5.3. After selecting the folder, click the "**export**" button (**Figure 39**). The exported data can be accessed in the previously chosen folder.

7.5.4. After customizing the trajectory points to export, where the target time range is trimmed, a dialog will pop up to give the user an option to export only the trimmed points or export all the existing points in the trajectory log (**Figure 40**).
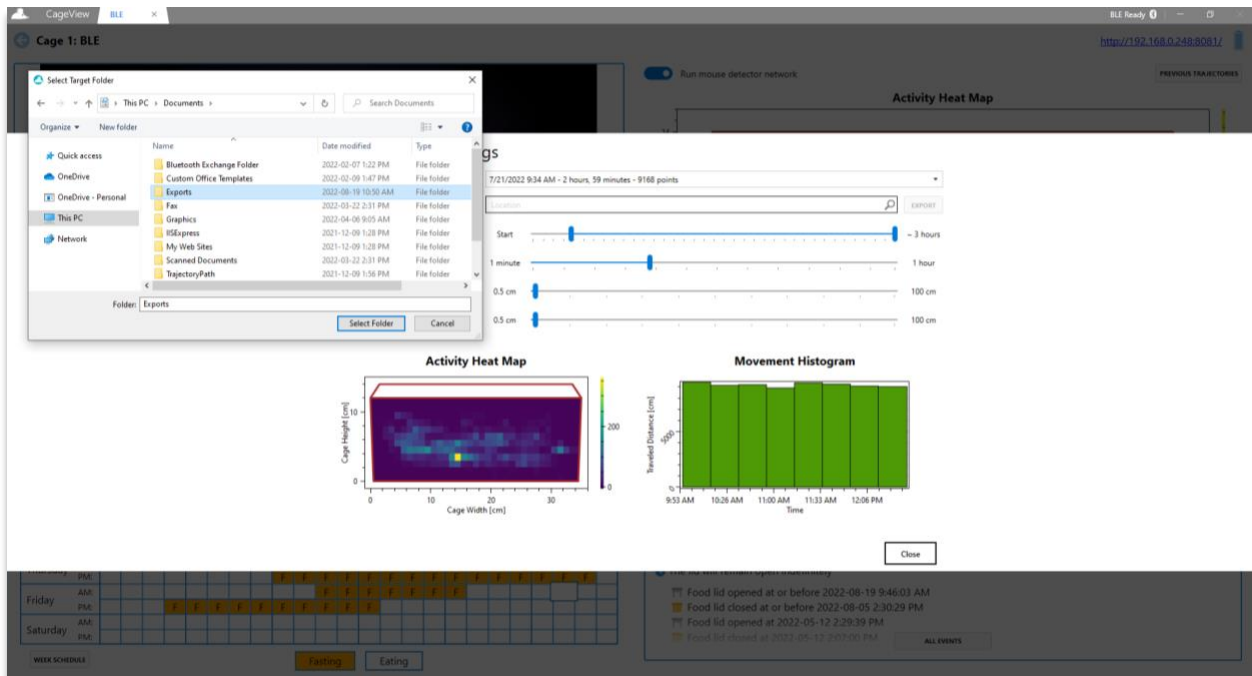

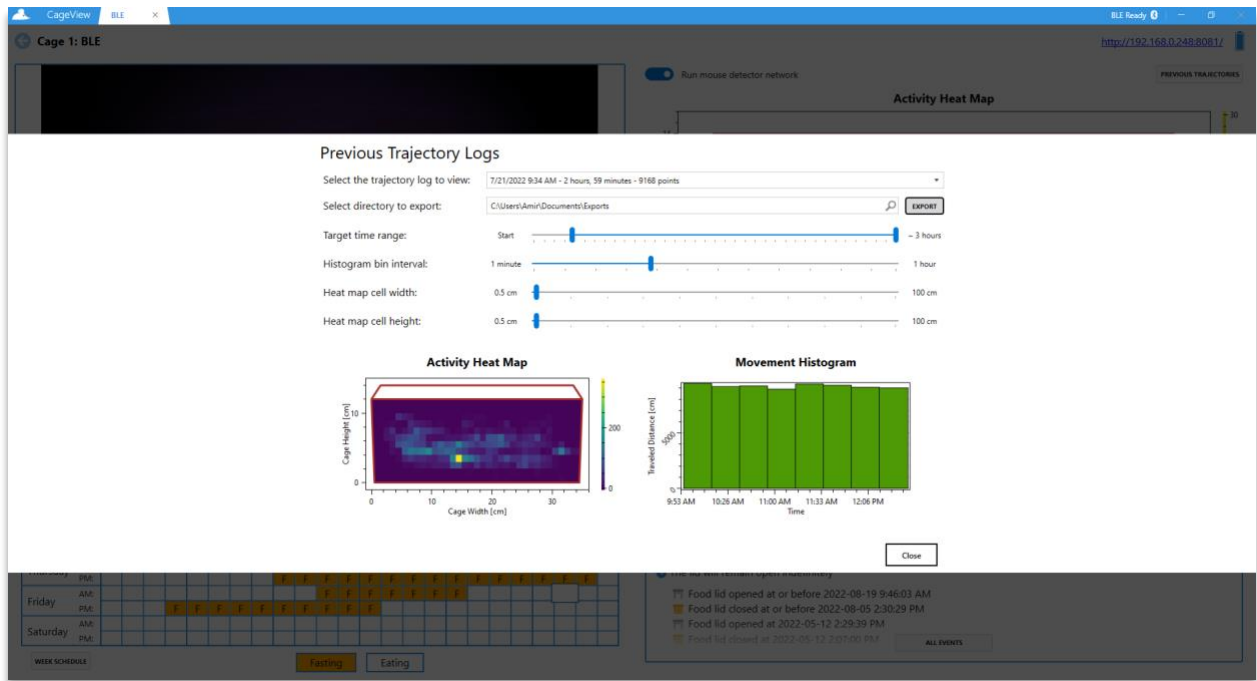**Figure 38. Selecting the folder for exporting**

Figure 39. Folder chosen for the trajectory log ready to export
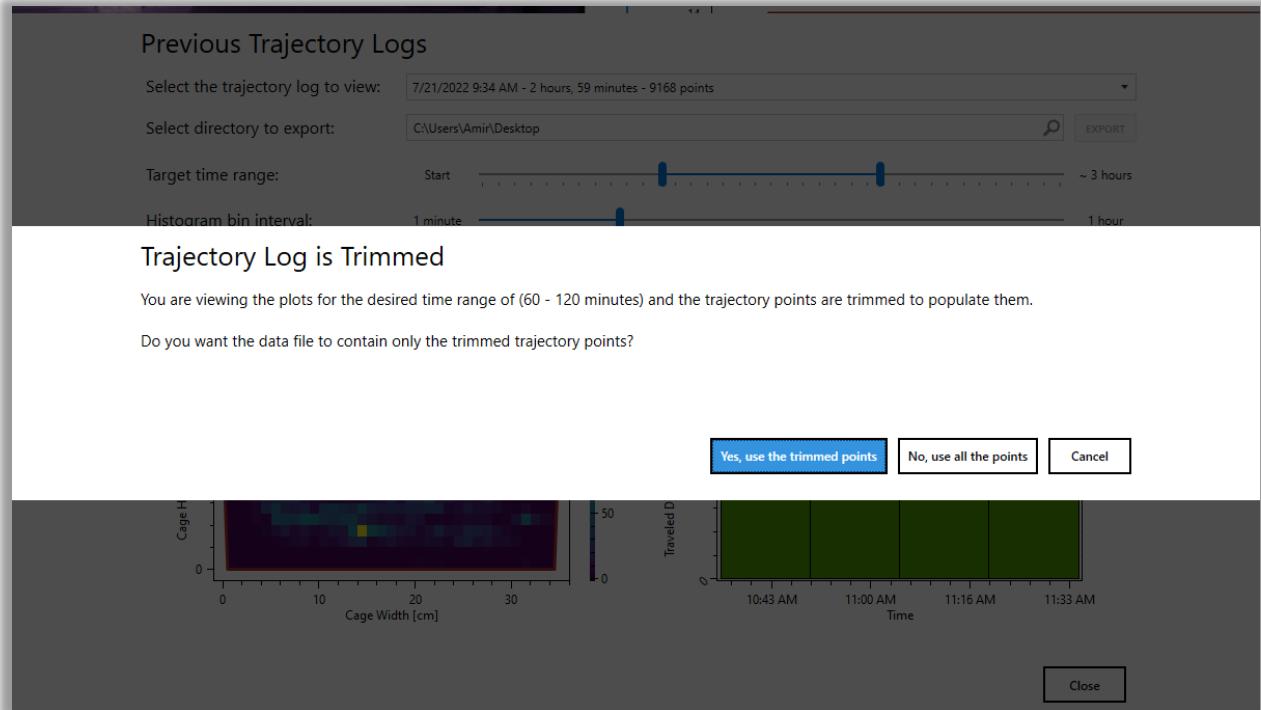

Figure 40. Export Trimming Confirmation Dialog

8. Assembling Smart Feeder

In this section, assembling the Smart Feeder system will be explained by a 5-step procedure. A video is provided with the package that shows how to assemble the Smart Feeder to the cage.

8.1. First mount part 2 on part 1, as shown in **Figure 41**.

NOTE: The first and second rails of part 2 (right side) must be inserted in the guide rails of part 1 (right side). Make sure the longitudinal rail of part 2 should come behind the extrusion on the left side of part 1.

8.2. Place part 3 and screw it with the help of bolts and the L key.

8.3. Place part 4 and screw it with the help of bolts and the L key.

8.4. Place part 5 and screw it with the help of bolts and the L key.

8.5. Place the battery pack and connect it to the port provided in part 3.

NOTE: Battery wire should pass through the U shape extrusion, as shown in **Figure 42**, and the battery bar will require 8 AA batteries.
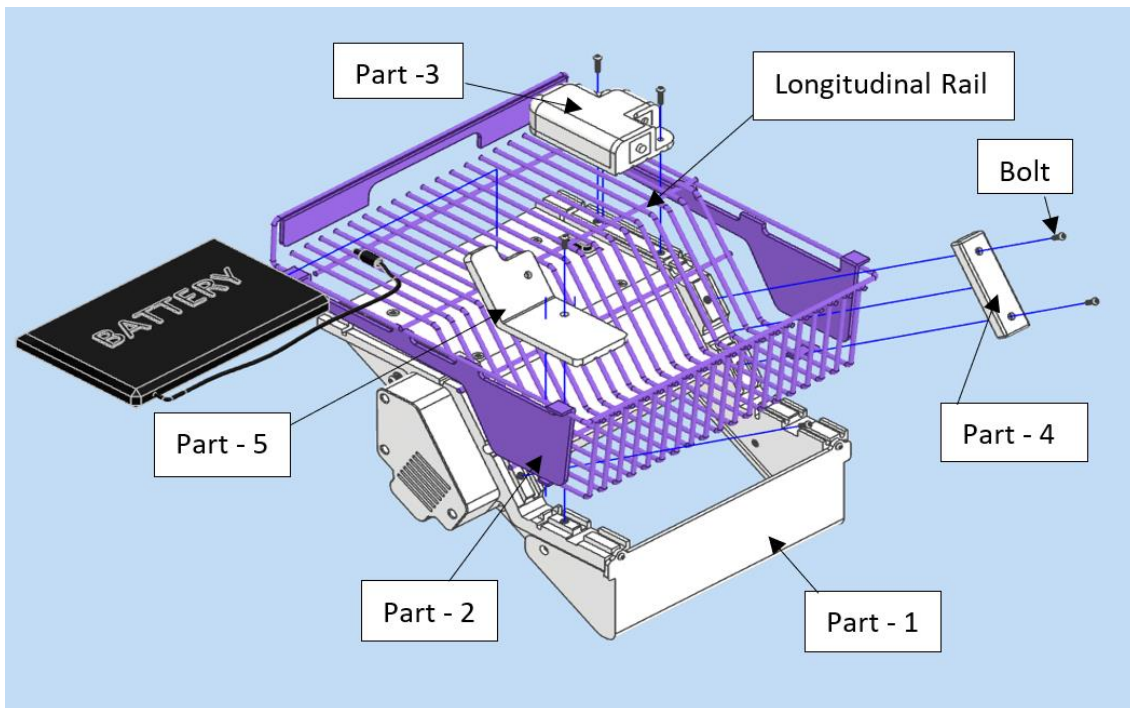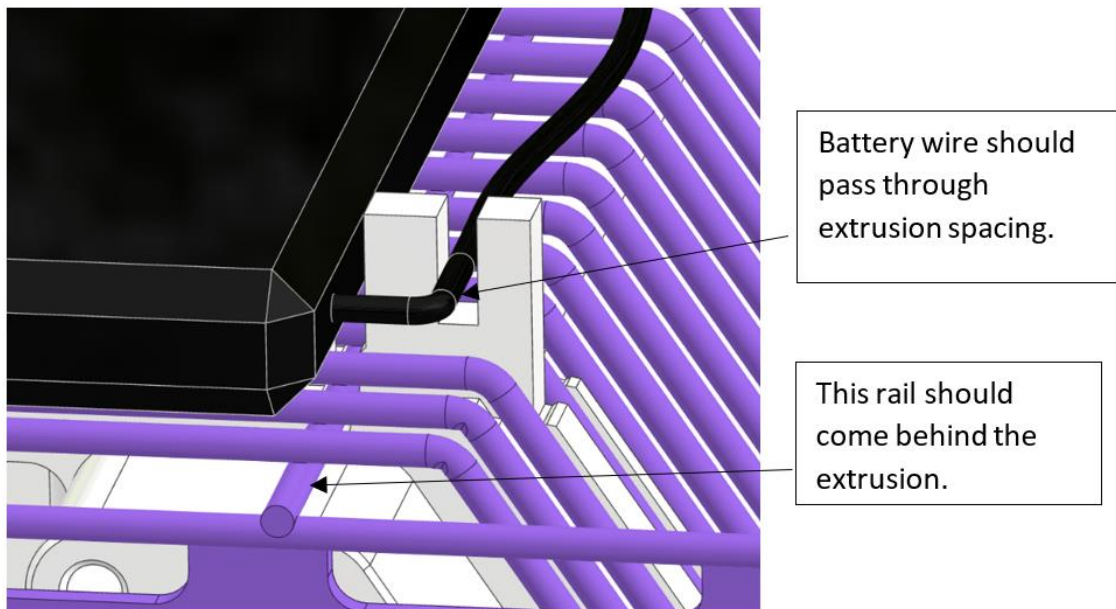
Figure 41. Different parts of the food control module
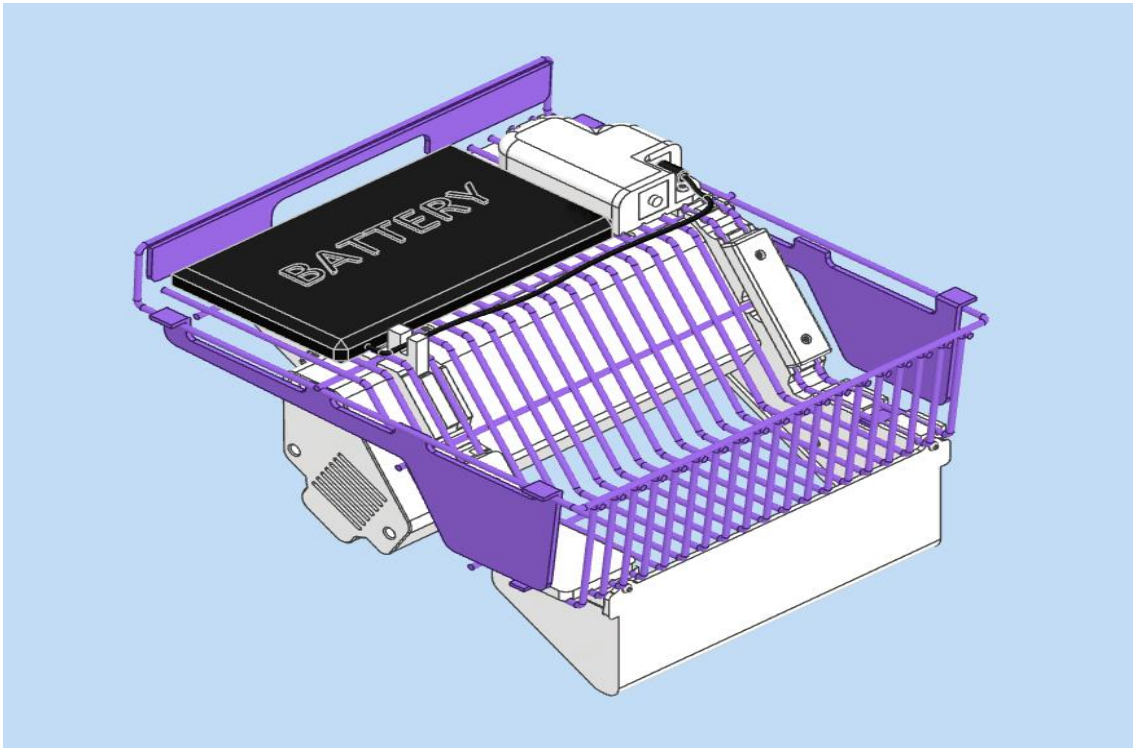

Figure 42. Battery wire and its path

Figure 43. Final assembly of the SmartFeeder

If you need any technical support, please contact our technical support:

302-135 Innovation Drive, R3T 6A8
Winnipeg, MB, Canada

(888) 822-7621

info@cageview.com