

# **GTAFE VR Training System for Hybrid Vehicle Powertrain V2.2**

**User and Customer Support Guide**



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# 1. Introduction

## 1.1. Objective

This manual is the user and customer support guide, intended to providing installation and operating guidance for users of VR Training System for Hybrid Vehicle Powertrain. Users mainly include students and teachers related to new energy automobiles in secondary and higher vocational schools, colleges, and universities.

## 1.2. Background

1. The software is named VR Training System for Hybrid Vehicle Powertrain V2.2.
2. The software is released by Shenzhen GTA Education Tech Ltd. and developed by its VR Department, and mainly intended for secondary and higher vocational schools, colleges, and universities involving new energy automobiles.
3. The software adopts online registration for encryption. User must apply for the registration code / license key to complete the license registration before use it.
4. The software must be operated on zSpace devices. It can also use naked eye 3D or zView for better teaching results.

## 1.3. Definition

Term	Definition or description
VR	Virtual reality
Virtual Assembly and Disassembly	Product disassembly and assembly based on virtual reality

## 1.4. References

VR Training System for Hybrid Vehicle Powertrain V2.1 – User and Customer Support Guide

## 2. Purpose

### 2.1. Function and Features

The software comprises of three modules: engine, transaxle, and principles of powertrain. It offers the structure, principles (Basic working principles, VVT-I principles, Atkinson Principles, Transaxle principles, and Principles of planetary gear mechanism), disassembly and assembly (providing guide, training, and examination) of Prius engine and transaxle, as well as Overall working principles and energy flow module of the powertrain.

Category	Name	Description
Function Requirements	Homepage	Select and enter function modules on the homepage.
	Main interface of	Select and enter function modules of engine

	hybrid engine	on the main interface.
	Main interface of hybrid transaxle	Select and enter function modules of transaxle on the main interface.
	Interface of powertrain principles	Display the working principles of Prius powertrain.
	Engine structure interface	Display the structure of Prius engine.
	Engine principle interface	Display the working principles of Prius engine, including Basic working principles, VVT-I principles, and Atkinson Principles.
	Engine disassembly interface	Display the disassembly process of Prius engine, offering three modes, i.e. guide, training, and examination.
	Engine assembly interface	Display the assembly process of Prius engine, offering three modes, i.e. guide, training, and examination.
	Transaxle structure interface	Display the structure of Prius transaxle.
	Transaxle principle interface	Display the working principles of Prius transaxle, including Transaxle principles and Principles of planetary gear mechanism

	Transaxle disassembly interface	Display the disassembly process of Prius transaxle, offering three modes, i.e. guide, training, and examination.
	Transaxle assembly interface	Display the assembly process of Prius transaxle, offering three modes, i.e. guide, training, and examination.
	Overall working principle interface of powertrain	Display the matching and working principles of the powertrain, i.e. engine and transaxle under different working conditions.
	Working principle interface of energy flow	Display the energy flow and interaction of the powertrain under different working conditions.

### 3. Runtime Environment

#### 3.1. Hardware Environment

zSpace 300 (Stylus, mouse, keyboard, and 3D Glasses).

#### 3.2. Software Environment

zSpace 300 related software and Windows 10 Pro (64-bit).

## 4. Operating Procedure

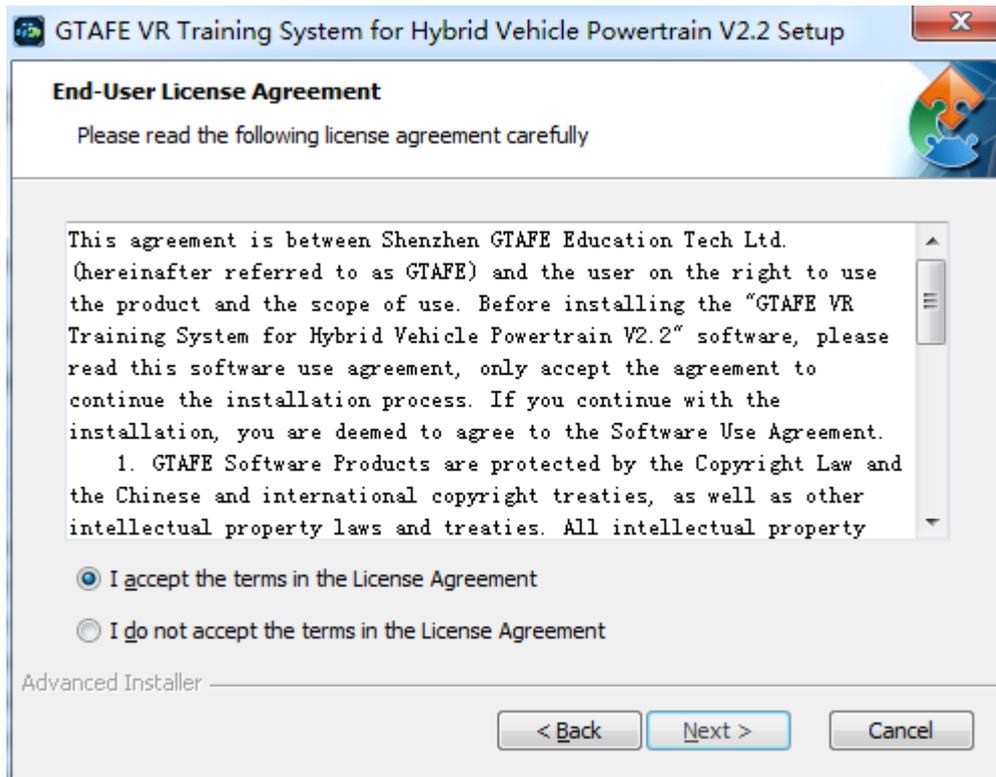
### 4.1. Installation and Initialization

Double click the setup program to enter the installation interface as shown

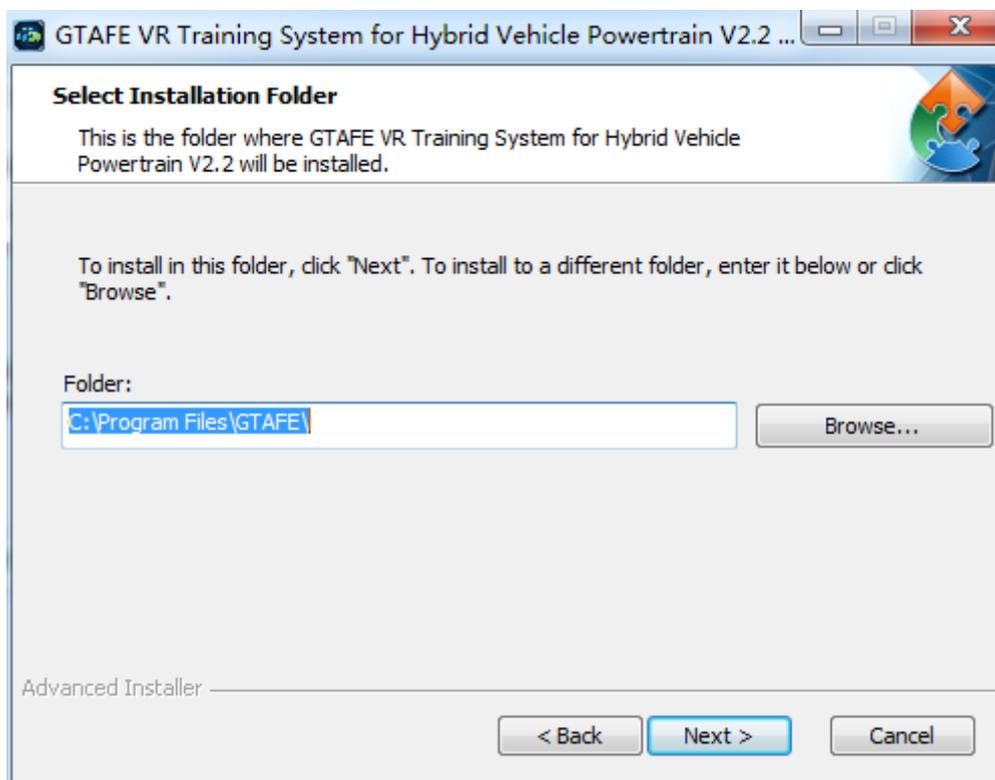
below.  GTAPE VR Training System for Hybrid Vehicle Powertrain V2.2.exe



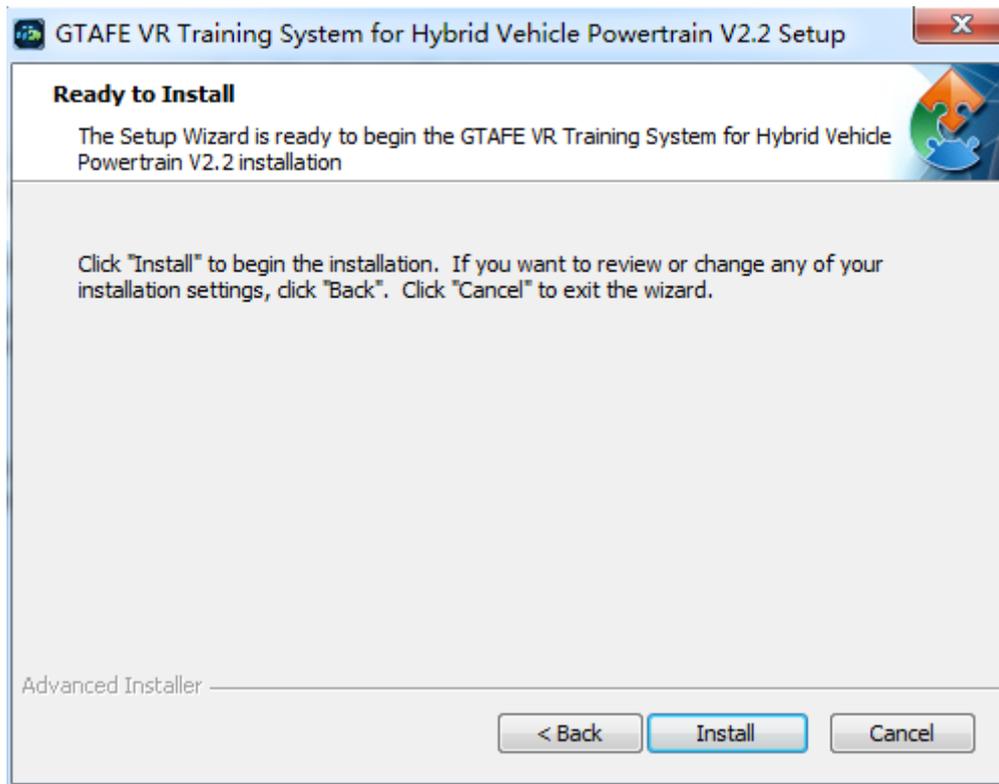
Click on "Next" and accept the terms.



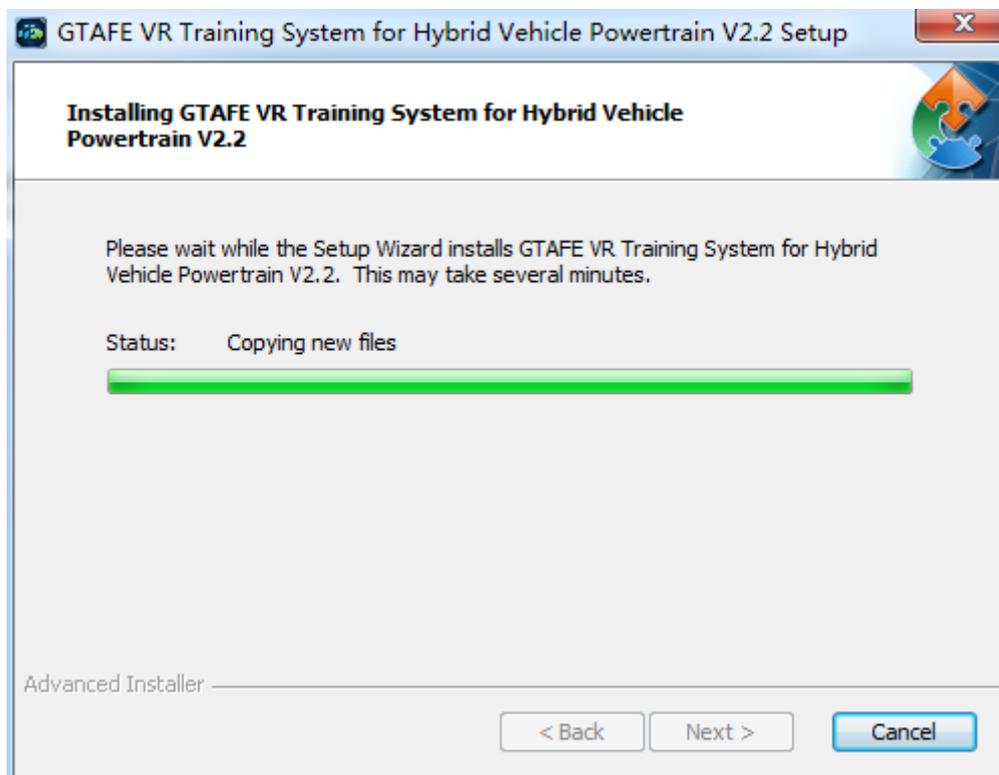
Click on "Next" , and then click on "Browse" to select a new directory, otherwise the default directory will be used.



Click on "Next" to prepare for the installation.



Click on "Install" to start the installation and configuration.



Click on "Finish" to exit.



A desktop shortcut will be generated.



## 4.2. Operation Description

### 4.2.1. User login

Double click on the setup program to enter the license registration interface.

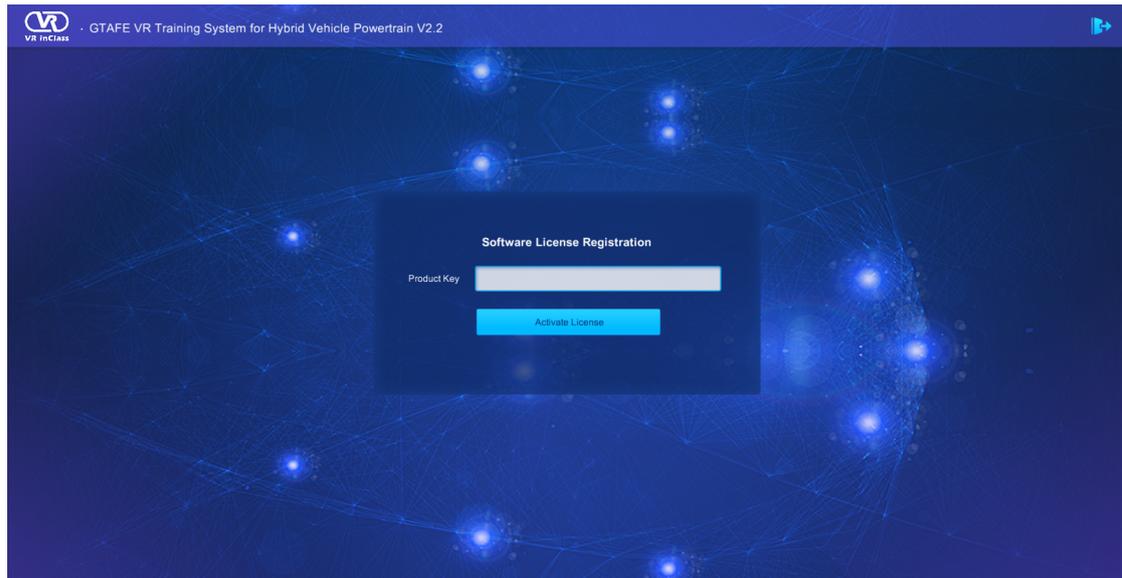


Figure 4-2-1 Software license registration

- ①→Exit button-exit the software.
- ②→Fill in the product key.
- ③→Click to complete the registration.

Fill in the product key obtained through the application code, and then click on “Activate License” to start using the software. Repeated registration is not needed if the key hardware equipment (CPU and hard disk) is not changed and the authorization has not expired.

User can click on the “Exit” button in the top right corner of the interface to exit the software.

#### 4.2.2. Homepage

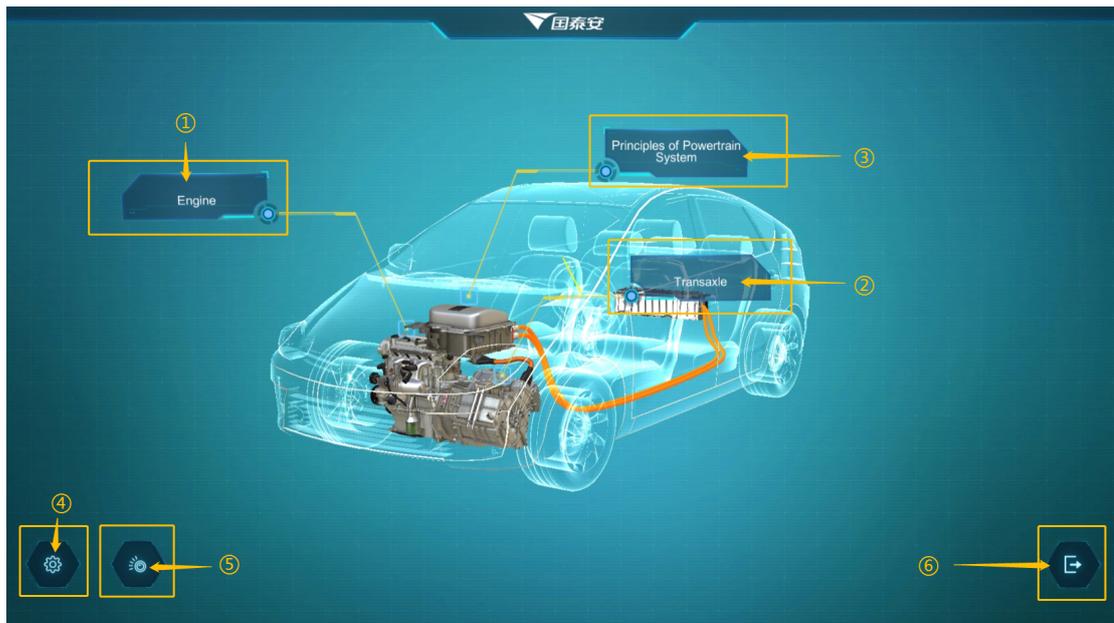


Figure 4-2-2-1 Homepage

- ①→Click to enter the engine module.
- ②→Click to enter the transaxle module.
- ③→Click to enter the module of working principles of powertrain.
- ④→Click to set up the software.
- ⑤→Click to connect zView or naked eye screen.
- ⑥→Click to exit the software.

1. Press the middle button of the stylus to select "Engine" , "Transaxle" , or "Working principles of powertrain" to enter the corresponding module.
2. Press the middle button of the stylus to select  button in the bottom left corner to set up the software, as 4-2-2-2.

- ① Vibration: If it is "on" , the stylus vibrates when an operation error occurs in the training.
- ② Pupillary distance: click on the "+/-" button to adjust the suitable pupillary distance (mm) for a better user experience.
- ③ Prompt time: user can set the flicker time for prompt on operation position in training. After click on the "Position Prompt" button, the

operation position will flicker twice per second if it is set as 2s, six times per second for 3s.

- ④ Beam length: click on the "+/-" button to adjust the beam length (mm) for a better user experience.
- ⑤ Click on the "Cancel" button to cancel the settings and return to the homepage; click on the "OK" button to save the settings.

3. Press the middle button of the stylus to select the  button to bring up the "Zview" and "Naked eye" for connection..
4. Press the middle button of the stylus to select the  button in the bottom right corner.
5. Press the left button of the stylus and click on the blank space in the left or right of the vehicle to rotate the vehicle to the left or right.



Figure 4-2-2-2 Settings

①→Select the language or the system.

- ②→If it is "open" , the stylus vibrates when an operation error occurs in the training.
- ③→Click on the "+/-" button to adjust the suitable pupillary distance (mm) for a better user experience.
- ④→Set the flicker time for prompt on operation position in training. ( After click on the "Position Prompt" button, the operation position will flicker twice per second if it is set as 2s, six times per second for 3s. )
- ⑤→Click on the"+/-" button to adjust the beam length (mm) for a better user experience.
- ⑥→Click to deactivate the license.
- ⑦→Click to save the settings.
- ⑧→Click to cancel the settings and return to the homepage

### 4.2.3.Engine

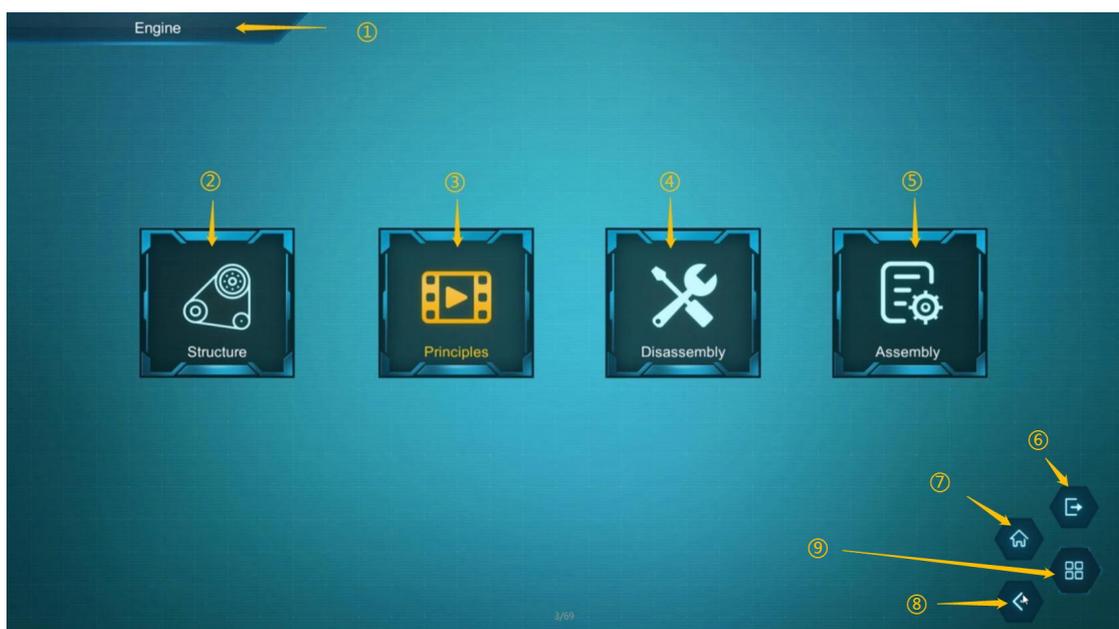


Figure 4-2-3 Main interface of engine

- ①→Current page
- ②→Click to enter the structure module
- ③→Click to enter the principles module
- ④→Click to enter the engine disassembly module
- ⑤→Click to enter the engine assembly module
- ⑥→Click to exit the software
- ⑦→Click to go back to the homepage
- ⑧→Click to go back to the previous page
- ⑨→Click to bring up operating buttons

1. Press the middle button of the stylus to select "Structure ", "Principles", "Disassembly", and "Assembly"" to enter the corresponding module.
2. Press the middle button of the stylus to select the  button in the bottom right corner to bring up ,  and .
3. Press the middle button of the stylus to select the  button to exit the software,  button to go back to the main page,  button to go back to the previous page.

#### 4.2.4. Engine structure



Figure 4-2-4-1 Engine structure

①→First-level Menu- click on the menu item to expand its corresponding second-level menu.

②→Second-level Menu-click on the menu item, the corresponding model will show solid view, while other models are perspective.

③→ “Post-explosion view” button-click to enter the post-explosion interface of the engine.

【Press the right button of the stylus to zoom in/out the model.

Press the left button of the stylus to restore the model to its original position.

Press the middle button of the stylus to rotate and zoom in/out the model.】

1. Press the middle button of the stylus to select the first-level menu item in the right to expand its corresponding second-level menu.
2. Press the middle button of the stylus to select the second-level menu item, the corresponding model will show solid view, while other models are perspective.
3. Press the right button of the stylus to zoom in/out the model
4. Press the left button of the stylus to restore the model to its original position.
5. Press the middle button of the stylus to drag, rotate and zoom in/out the model.
6. Press the middle button of the stylus to click on the Bulb button beside the first and second level menus, as shown as figure 4-2-4-2. The status is illustrated as follows:

- ① When the bulb is fully- illuminated, the corresponding model shows solid view.

- ② When the bulb is half-illuminated, the corresponding model shows transparent view.
  - ③ When the bulb is blank (unilluminated), the corresponding model is hidden and not displayed.
7. Press the middle button of the stylus to select "Post-explosion view" button to enter the post-explosion interface of the engine, as shown as figures 4-2-4-3 and 4-2-4-4. The operation instructions are as follows:
- 7.1 Press the middle button of the stylus to select the model outlined in yellow in the center of the interface, drag, rotate and zoom in/out the model.
  - 7.2 Press the middle button of the stylus to select other model to rotate the model. The selected model will be outlined in green, and its corresponding name will pop up.
  - 7.3 Press the middle button of the stylus to select the Restore button to go back to the engine structure interface (Figure 4-2-4-1).
  - 7.4 If there are multiple components of the same type (such as main bearing, piston, and valve), click on the rightmost / uppermost model, and then all models of the type will be outlined and can be dragged and rotated as a whole (see Figure 4-2-4-3).



Figure 4-2-4-2 "Bulb" button in structure

- ①→Click on the bulb button, when the bulb is fully- illuminated, and then the corresponding model shows solid view.
- ②→When the bulb is half-illuminated, the corresponding model shows transparent view.
- ③→When the bulb is blank, the corresponding model is hidden.

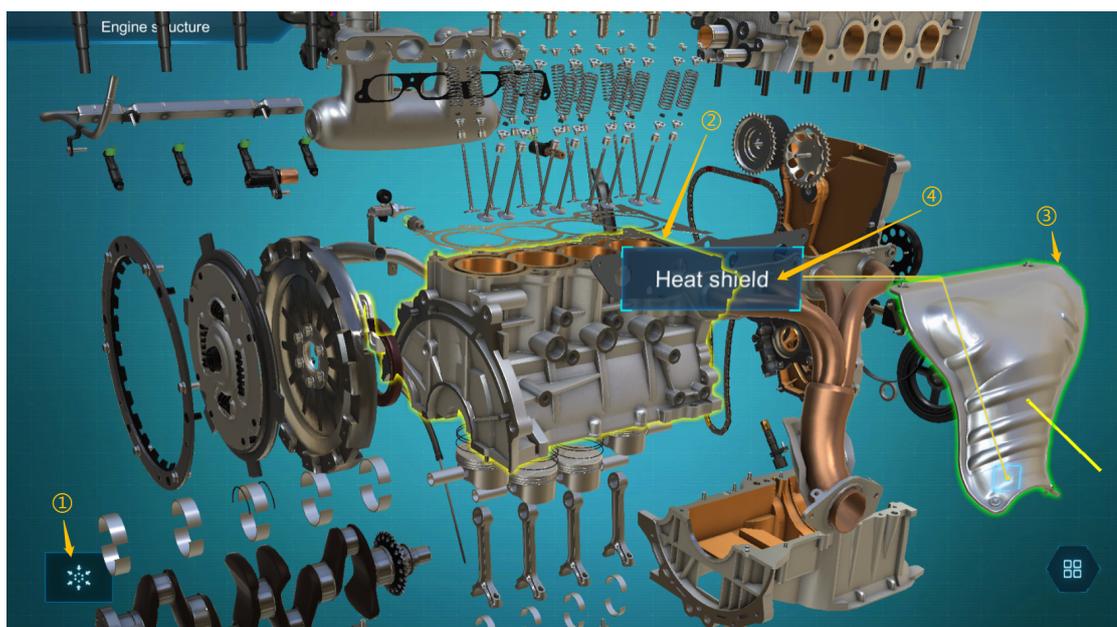


Figure 4-2-4-3 Post-explosion interface

- ①→Click on the Restore button to go back to the engine structure interface.
- ②→Click on the model outlined in yellow to drag, rotate and zoom in/out the model.
- ③④→Click on any model to rotate it. The selected model will be outlined in green, and its corresponding name will pop up.

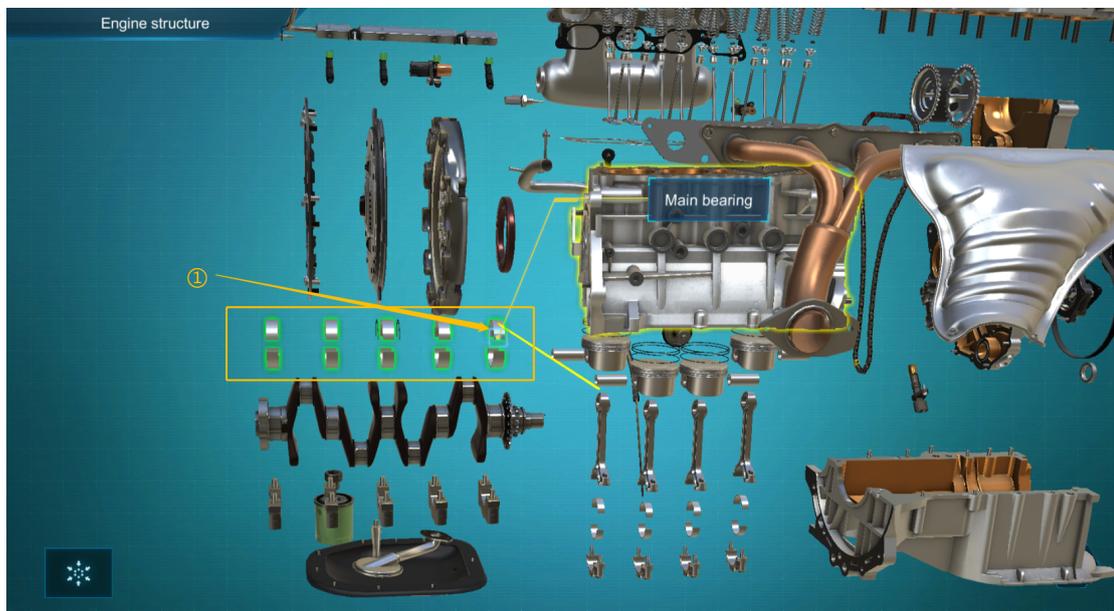


Figure 4-2-4-4 Batch selection in the post-explosion interface

- ①→If there are multiple components of the same type, click on the rightmost / uppermost model, and then all models of the type will be outlined and can be dragged and rotated as a whole.

#### 4.2.5. Engine principles

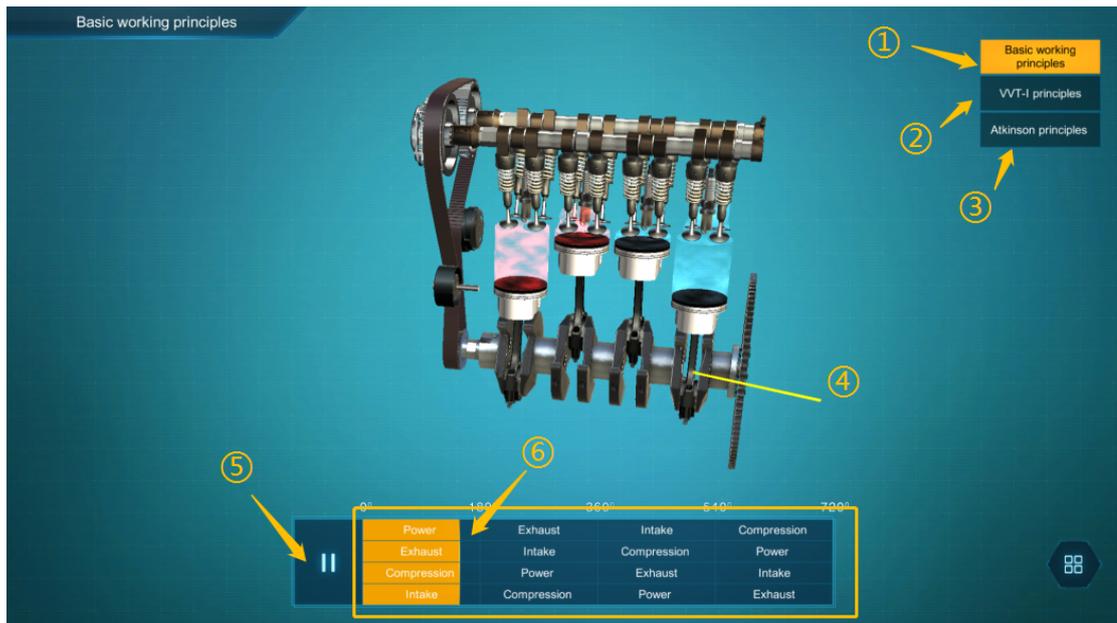


Figure 4-2-5-1 Engine Principles scenario

- ①→The "Basic Working Principles" interface is default
- ②→Click to enter the "VVT-I Principles" interface
- ③→Click to enter the "Atkinson Principles" interface
- ④→Press the middle button of the stylus to click on the model to drag and rotate it.
- ⑤→Click on "Pause" button to pause the animation
- ⑥→After pause, press the middle button of the stylus to drag the yellow progress area or area border to control the progress of the animation.

1. After entering the engine principles page, user enters the "Basic working principles" by default, where the engine working animation is repeated.
2. Press the middle button of the stylus to click on the "VVT-I principles" or "Atkinson principles" to enter the corresponding principle interface.

3. Press the middle button of the stylus to select the model, and drag, rotate and zoom in/out.
4. Press the right button of the stylus to select the model, and drag it back and forth to zoom in/out.
5. Press the left button of the stylus to restore the model to its original position.
6. Press the middle button of the stylus to click on the "Pause" button in the bottom left corner of the interface to pause the animation. (After click, the "Pause" button will change into the "Play" button. Click on the button again to continue to play).
7. After pause, press the middle button of the stylus to drag the animation progress area highlighted in yellow or area border to control the progress of the animation.
8. The VVT-I Principles scenario is shown as figure 4-2-5-2. Click on the "Pause" button in the bottom left corner to pause the animation. (After click, the "Pause" button will change into the "Play" button. Click on the button again to continue to play).
9. After pause, press the middle button of the stylus to click on the number button to jump to the corresponding step for playing.
10. In the VVT-I Principles scenario, press the right button of the stylus to select the model, and drag it back and forth to zoom in/out. Press the left button of the stylus to restore the model to its original position.

11. The Atkinson Principles scenario is shown as figure 4-2-5-3. Click on the "Pause" button to pause the animation. (After click, the "Pause" button will change into the "Play" button. Click on the button again to continue to play).
12. Click on the "Traditional engine work cycle" button or the "Atkinson cycle" at the bottom of the interface to switch to the corresponding scenario.
13. In the Atkinson Principles scenario, press the middle button of the stylus to select the model, and drag, rotate and zoom in/out. Press the right button to drag it back and forth to zoom in/out. Press the left button to restore the model to its original position.

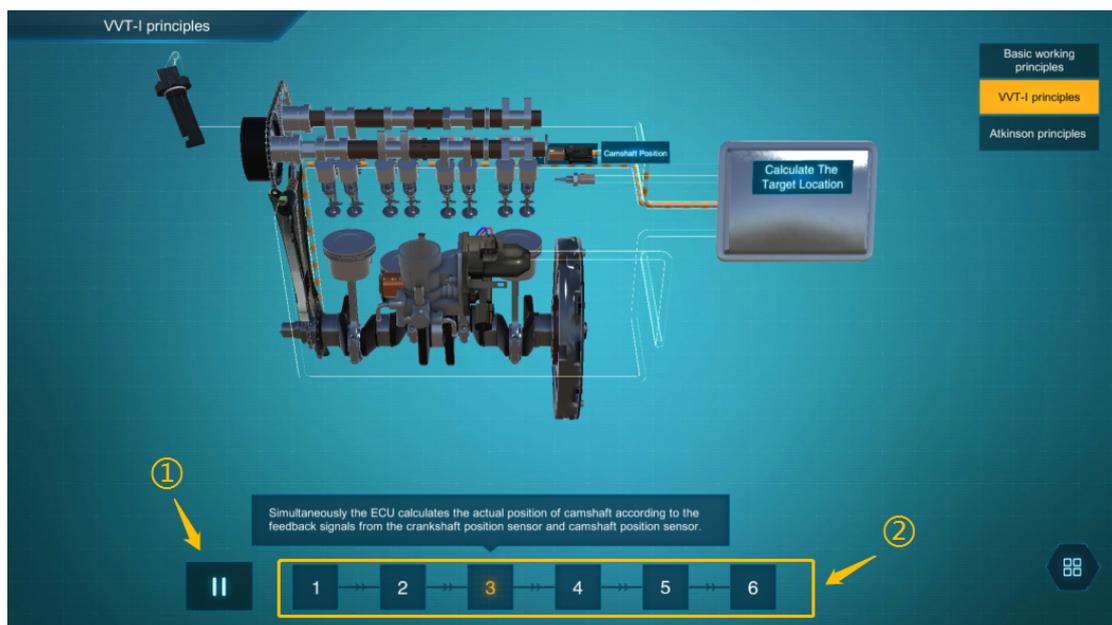


Figure 4-2-5-2 VVT-I Principles scenario

①→Click to pause the animation.

②→After pause, click on the number button to jump to the corresponding step for playing



Figure 4-2-5-3 Atkinson Principles scenario

- ①→Click to view the "Traditional engine work cycle".
- ②→Click to view the "Atkinson cycle".
- ③→Click to pause the animation
- ④→Press the middle button of the stylus to click on the model to drag and rotate it.

#### 4.2.6.Engine disassembly

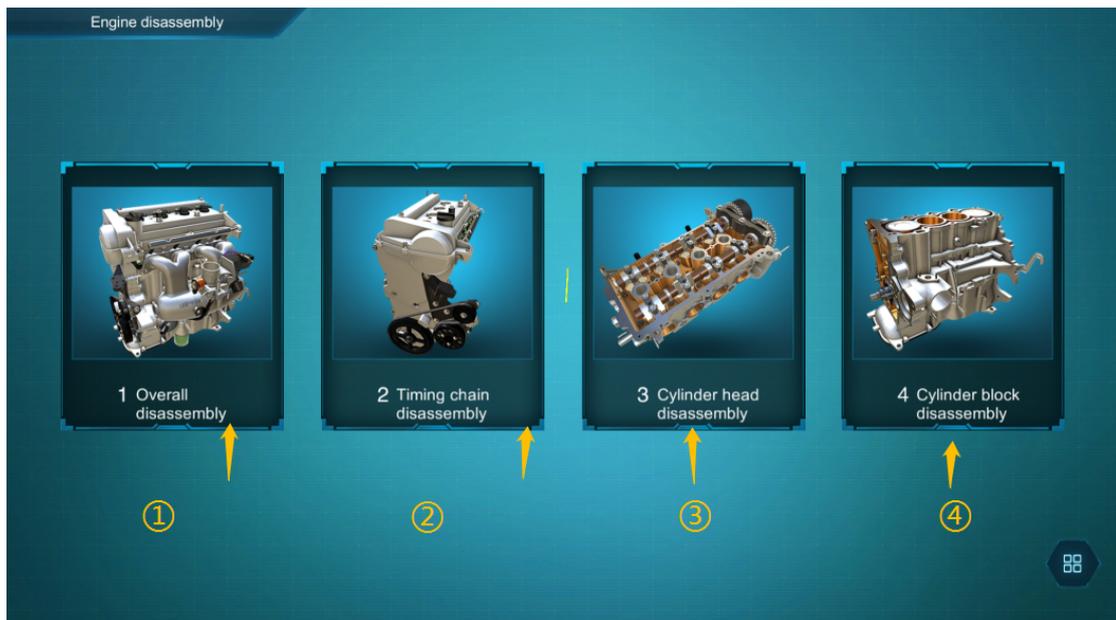


Figure 4-2-6-1 Main interface of engine disassembly

1. In the engine disassembly, there are four sub-interfaces according to disassembly procedure, i.e. "Overall Disassembly", "Timing Chain Disassembly", "Cylinder Head Disassembly", and "Cylinder Block Disassembly".



Figure 4-2-6-2 Operation of engine disassembly

Tips box 【①→Tool currently needed

②→Operating step currently needed

③→Current operation progress

④→ "Jump" button-click to directly jump to the corresponding step】

⑤→Tool currently used is highlighted

⑥→Current operation position is highlighted in green

⑦→Move the tool to the operation position to trigger the operation

⑧→ 【 "Reset" button-click to start from the first step

"Text tips" -click to hide the tips box

"Position Prompt" button-click to switch the model to the best angle and highlight the position that needs to be operated

"Operating Record" button-click to view the operating records

"Undo" button-click to undo the current operation and go back to the previous step.】

⑨→ "Guide" button-click to switch to the guide mode

- ⑫→ "Mode" button-click to switch to different modes (guide mode is default)
- ⑩→ "Training" button-click to switch to the training mode
- ⑪→ "Examination" button-click to switch to the examination mode

1. Press the middle button of the stylus to click on the "Mode" button in the bottom left corner of the interface, to bring up the "Guide", "Training", and "Examination" buttons for selection. The guide mode is default after entering the disassembly interface. The differences between the three modes are as follows:

① Guide mode: the model automatically rotates to the best viewing angle, tool and operation position flicker, and the tips box always remains open.

② Training mode: user needs to rotate the model to the operating angle manually, tool and operation position do not automatically flicker (except clicking on the "Position Prompt" button). The tips box is open by default and can be closed by the "Text Tips" button at the bottom.

④ Examination mode: user needs to rotate the model to the operating angle manually, tool and operation position do not flicker, and the tips box is closed.

2. Press the middle button of the stylus to select the model, and drag, rotate and zoom in/out. Press the right button to drag it back and forth to zoom in/out. Press the left button to restore the model to its original position.

3. Press the middle button of the stylus to click on the "Reset" button at the

bottom of the interface, current operation will all be eliminated, and user will start from the first step.

4. Press the middle button of the stylus to click on the "Text Tips" button at the bottom to show or hide the tips box.
5. Press the middle button of the stylus to click on the "Position Prompt" button at the bottom. Then the model will be switched to the best angle and the tool and position that need to be operated will be highlighted.
6. Press the middle button of the stylus to click on the "Operating Record" button to retrieve and view the operating records.
7. Press the middle button of the stylus to click on the "Undo" button to undo the current operation and go back to the previous step.
8. Press the middle button of the stylus to select the correct tool from the toolbar. Move the front end of tool to the operation position to trigger the operation. If the tool is hand, move the front end of beam directly.
9. The operating record is shown as figure 4-2-6-3. Click on the "Steps" or "Operating Record" button to view all of the standard operating procedures or the records of operation completed.
10. Click on the "Close" button to close the operating records. Click on the "Export" button to export the records to a specified directory in PDF.

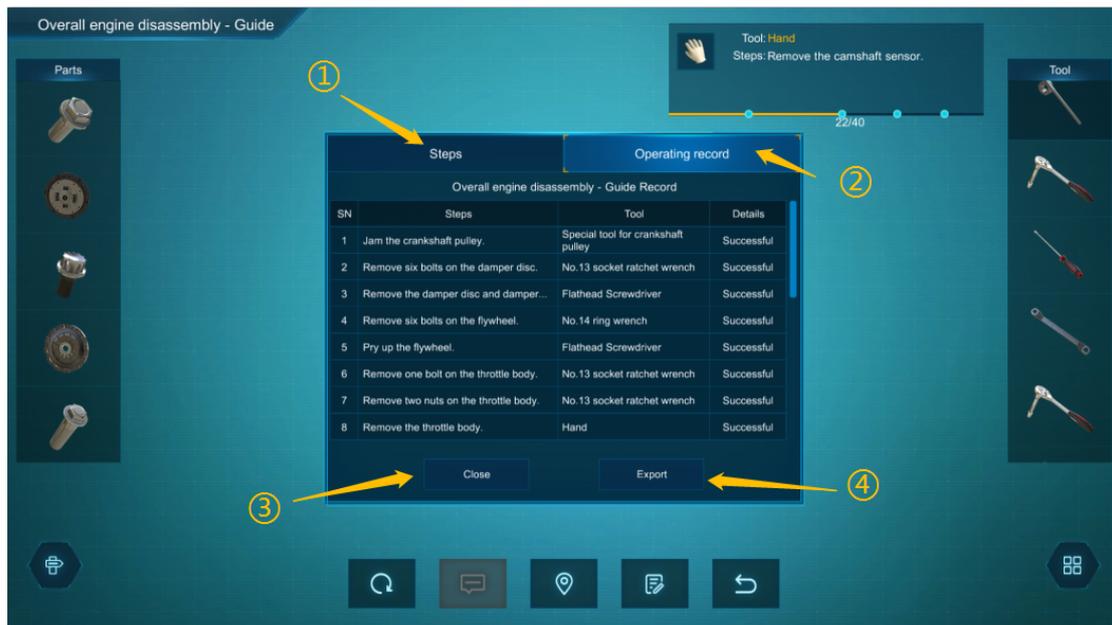


Figure 4-2-6-3 Illustration of operating records

- ①→Click to view all of the standard operating procedures
- ②→Click to view the records of operation completed
- ③→Click to close the operating records
- ④→Click to export the records to a specified directory in PDF

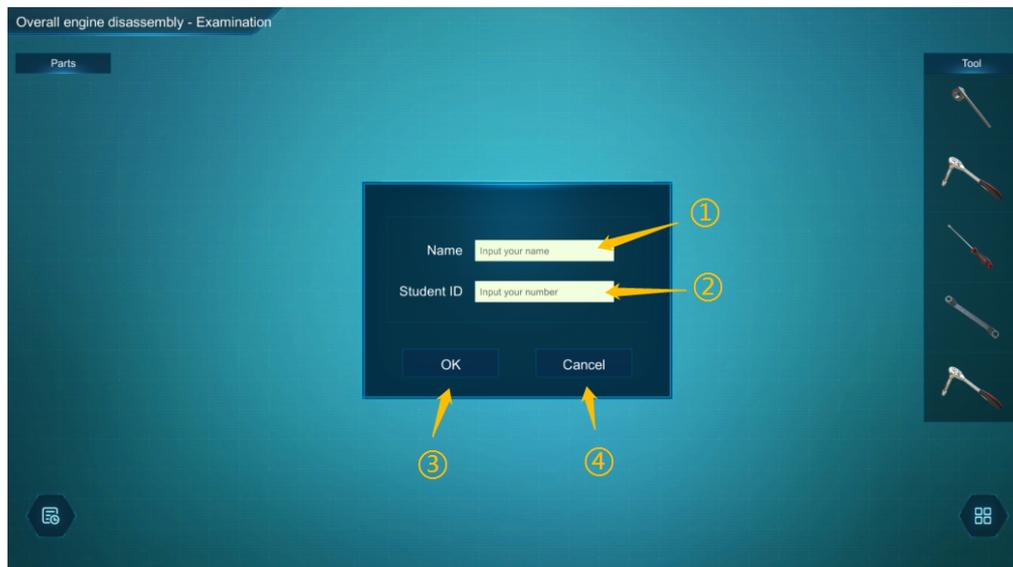
11. Examination mode is shown as figure 4-2-6-4. When it is switched to the examination mode, user needs to enter the name and Student ID in the pop-up box. Click on "OK" button to enter the examination, or click on "Cancel" button to close the window and go back to the previous operation interface.

12. After entering the examination, the countdown timer can be found at the top of the interface. The maximum time allowed for every examination is 10 minutes. When all operations are completed or examination time has run out, the examination results will be automatically submitted.

13. At the end of the examination, the operating record will pop up, with incorrect operating steps highlighted in yellow. Click on the "Close" button to close the operating records. Click on the "Export" button to export the records to a specified directory in PDF.

14. Click on the "Record" button at the bottom to retrieve and view the examination record. Click on the "Re-examine" button to restart the examination.

15. If users exit the examination halfway, the current examination record will be automatically saved in the specified directory.



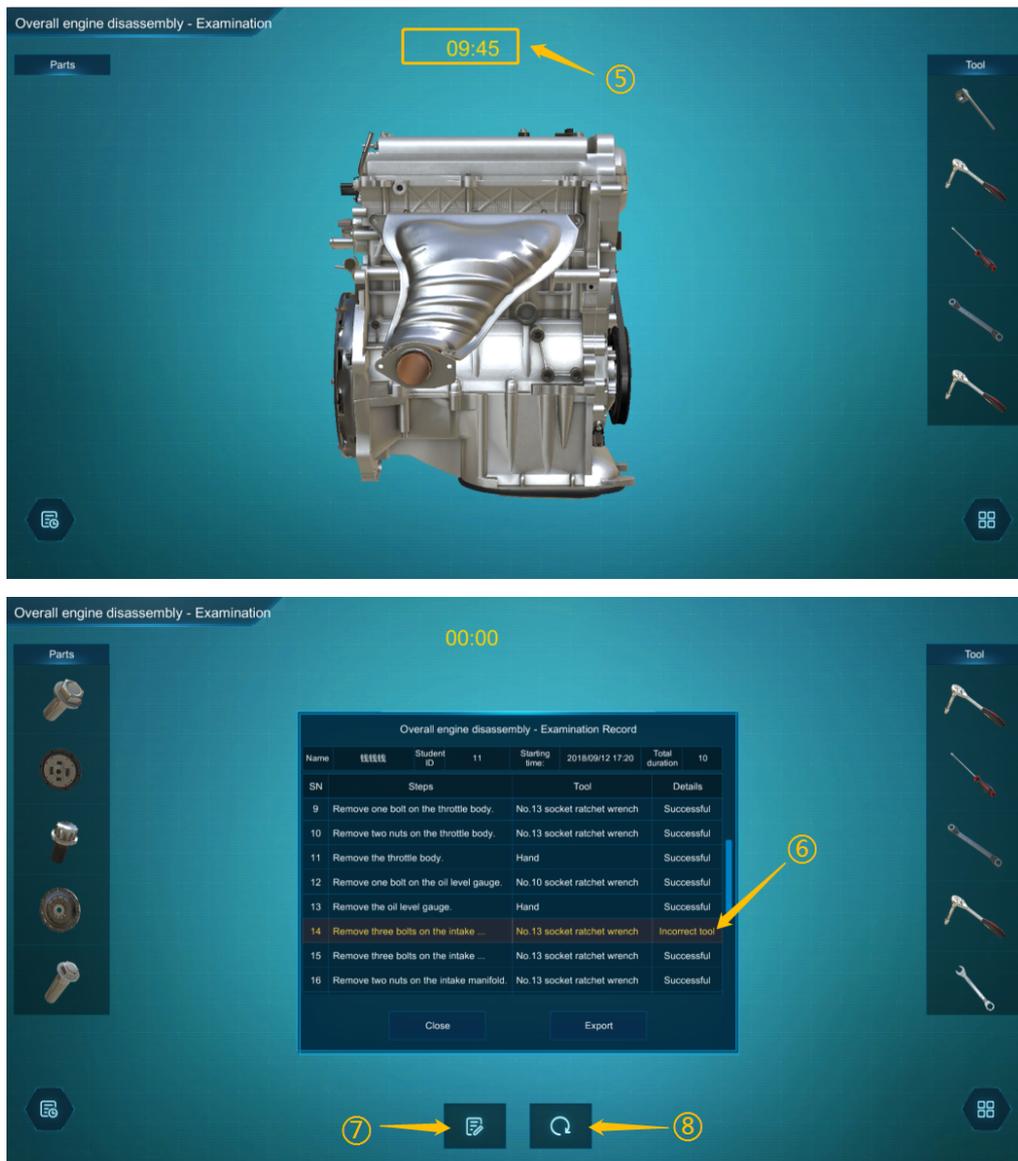


Figure 4-2-6-4 Illustration of examination mode

- ①→Click to enter the name
- ②→Click to enter the student ID
- ③→Click to start the examination
- ④→Click to cancel the examination
- ⑤→Remaining examination time
- ⑥→Incorrect steps is highlighted in yellow
- ⑦→Click to close the operation records
- ⑧→Click to export the operation records

#### 4.2.7. Engine assembly

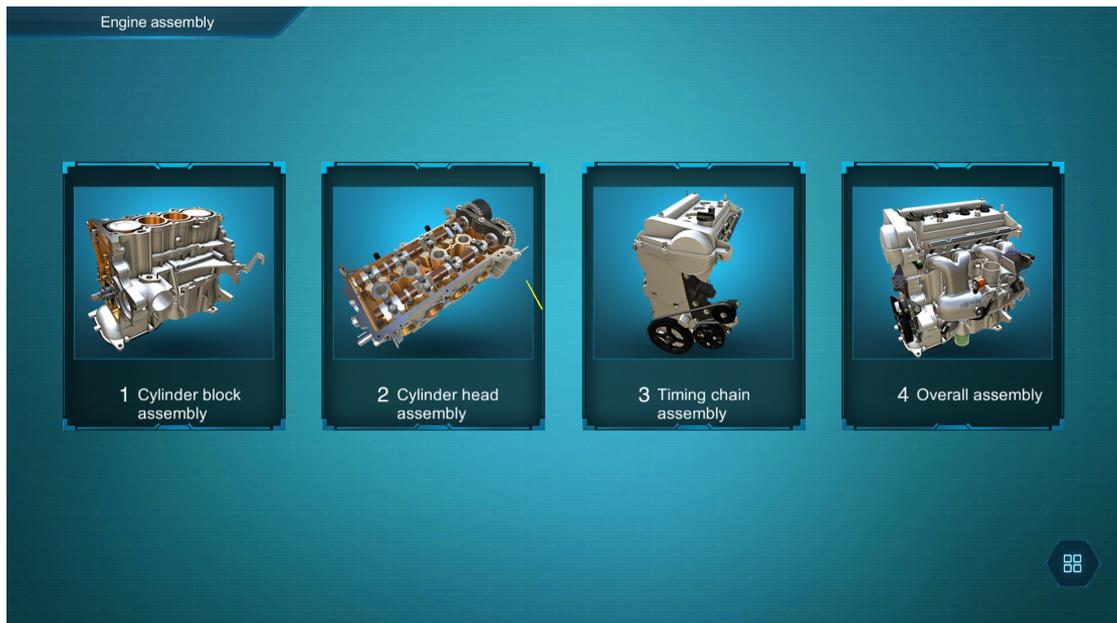


Figure 4-2-7-1 Main interface of engine assembly

1. In the engine assembly, there are four sub-interfaces according to assembly procedure, i.e. "Cylinder Block Assembly", "Cylinder Head Assembly", "Timing Chain Assembly", and "Overall Assembly".
2. The basic operation is identical with that of the disassembly, however,
  - ① While using the "hand", press the middle button of the stylus to select the correct part from the part bar, move it to the installation position and click to complete the installation.
  - ② While installing a bolt /nut, press the middle button of the stylus to click on the correct tool in the toolbar, use the rear end of the wrench to touch the correct bolt / nut in the part bar. When the front end of the beam changes into the bolt /nut, move it to the installation location and click to complete the installation. See figure 4-2-7-2.
  - ③ To lubricate and install the part, press the middle button of the stylus to select the lubricating oil in the toolbar, use the bottom of the oil bottle to

touch the correct part in the part bar. When the front end of the beam changes into the part, move it to the installation location and click to complete the installation. See figure 4-2-7-2.

3. In the assembly scenario, press the middle button of the stylus to select the model (including parts in the part bar and tools in the toolbar), and drag, rotate and zoom in/out. Press the right button to drag it back and forth to zoom in/out. Press the left button to restore the model to its original position.



Figure 4-2-7-2 Operating instructions on installing a bolt/nut

- 1) Click on the wrench
- 2) Use the rear end of the wrench to touch the corresponding bolt in the part bar
- 3) When the front end of the beam changes into the bolt, move it to the correct installation location and click to complete the installation.



Figure 4-2-7-3 Operating instructions on installing lubricating parts

It is required to lubricate and install the part

- 1) Click on the lubricating oil
- 2) Use the bottom of the oil bottle to touch the corresponding part.
- 3) When the front end of the beam changes into the lower bearing, move it to the right installation location and click to complete the installation.

#### 4.2.8. Transaxle

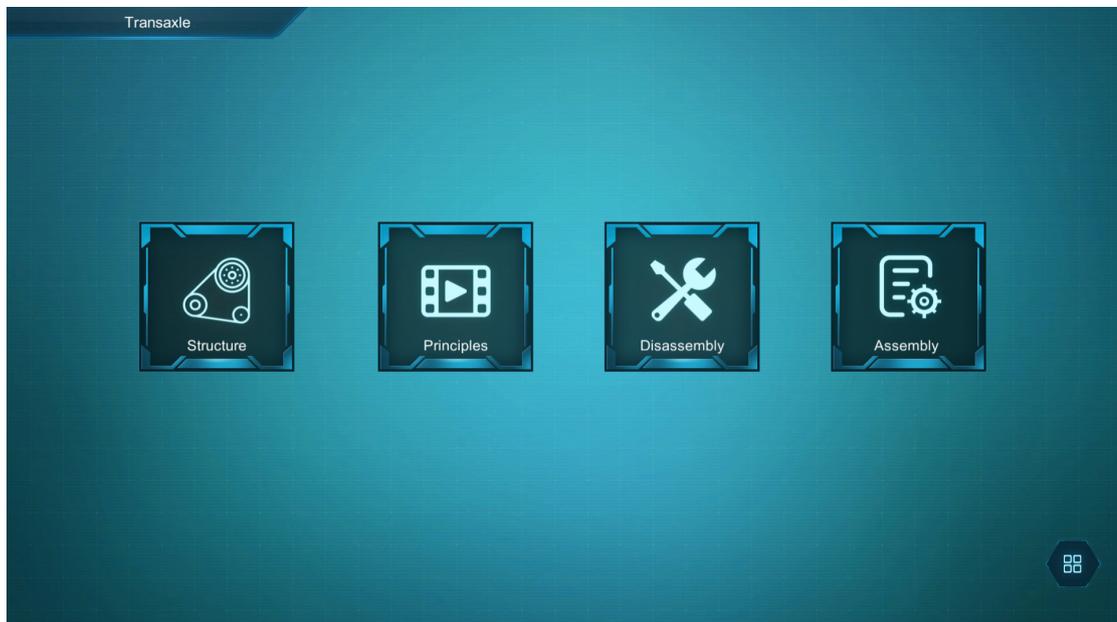


Figure 4-2-8 Main interface of transaxle

1. As for the operation of the main interface of transaxle, please refer to 4.2.3.

#### 4.2.9. Transaxle structure



Figure 4-2-9 Transaxle structure interface

1. As for the operation of the transaxle structure, please refer to 4.2.4.

#### 4.2.10. Transaxle principles



Figure 4-2-10-1 Transaxle principles

- ①→"Transaxle Principles" is default
- ②→Click to switch to "Principles of planetary gear mechanism"
- ③→ "Tips" button-click to view the operating tips
- ④→ "Ignition" button-click to start the vehicle
- ⑤→ "Gear" button-click to change gear
- ⑥→ "Brake" button-click to brake
- ⑦→ "Accelerator" button-click to press accelerator pedal; the first click means "press lightly" , while the second click means "press hard"

1. After entering the transaxle principles page, user enters the "Transaxle principles" by default.
2. Press the middle button of the stylus to select "Principles of planetary gear mechanism" in the right to enter the corresponding principle interface.
3. Press the middle button of the stylus to select the model, and drag, rotate and zoom in/out.
4. Press the right button to drag the model back and forth to zoom in/out.
5. Press the left button to restore the model to its original position
6. Press the middle button of the stylus to click on the "Tips" button to view the operating tips.
7. Press the middle button of the stylus to click on the "Ignition" button to start the vehicle.
8. Press the middle button of the stylus to click on the "Gear" button to change gear.
9. Press the middle button of the stylus to click on the "Brake" button to brake.
10. Press the middle button of the stylus to click on the "Accelerator" button to press accelerator pedal; the first click means "press lightly" , while the second click means "press hard" .
11. See figure 4-2-10-2 for special instructions.

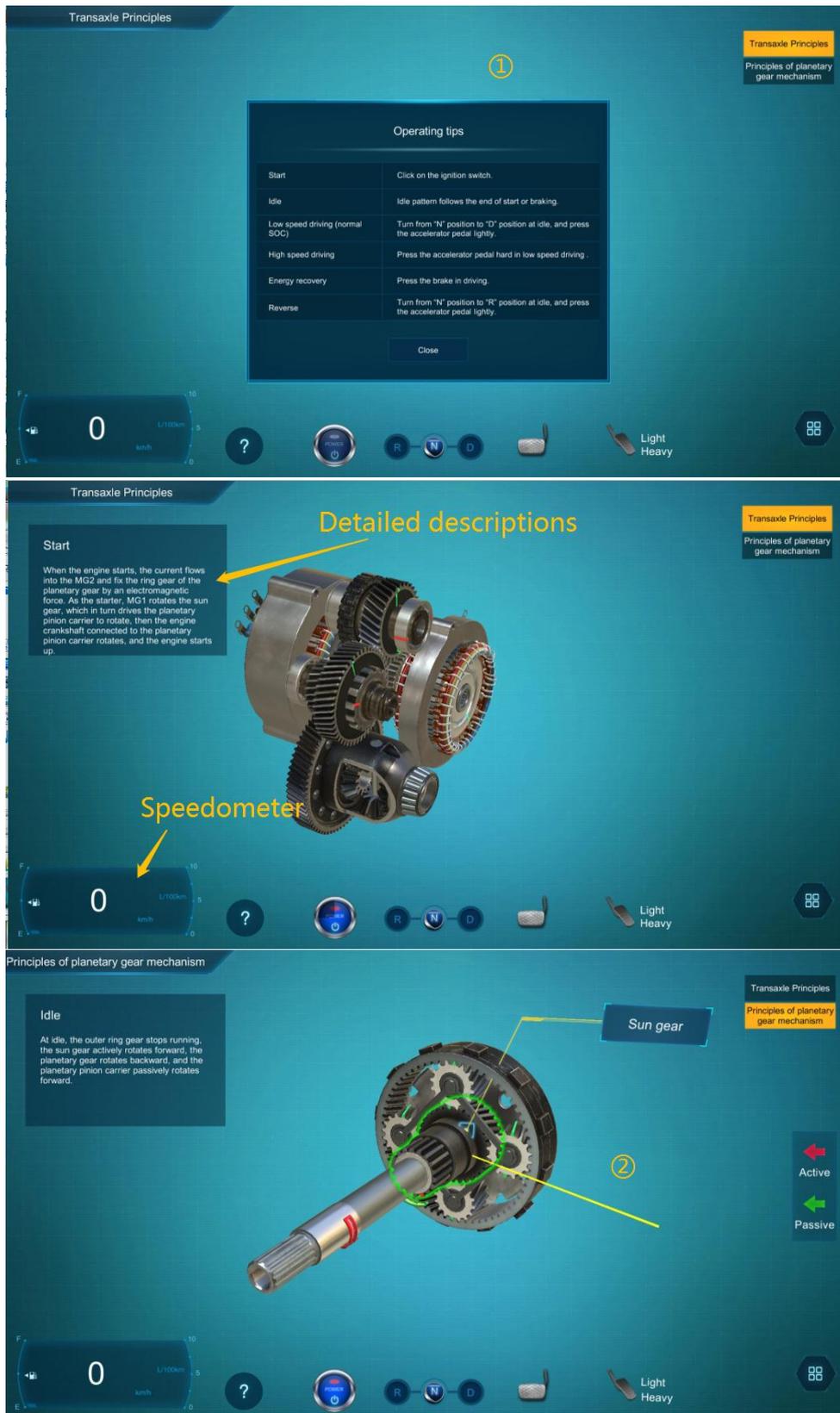


Figure 4-2-10-2 Special instructions for transaxle principles

- ①→Indicating how to use the buttons in the bottom to conduct different operations
- ②→Press the middle button of the stylus to click on the model to rotate it. The model will be outlined in green, and its corresponding name will pop up.

### 4.2.11. Transaxle disassembly

1. All operations of transaxle disassembly are the same as that of engine disassembly (see 4.2.6).

### 4.2.12. Transaxle assembly

1. All operations of transaxle assembly are the same as that of engine assembly (see 4.2.7).

### 4.2.13. Working principles of powertrain

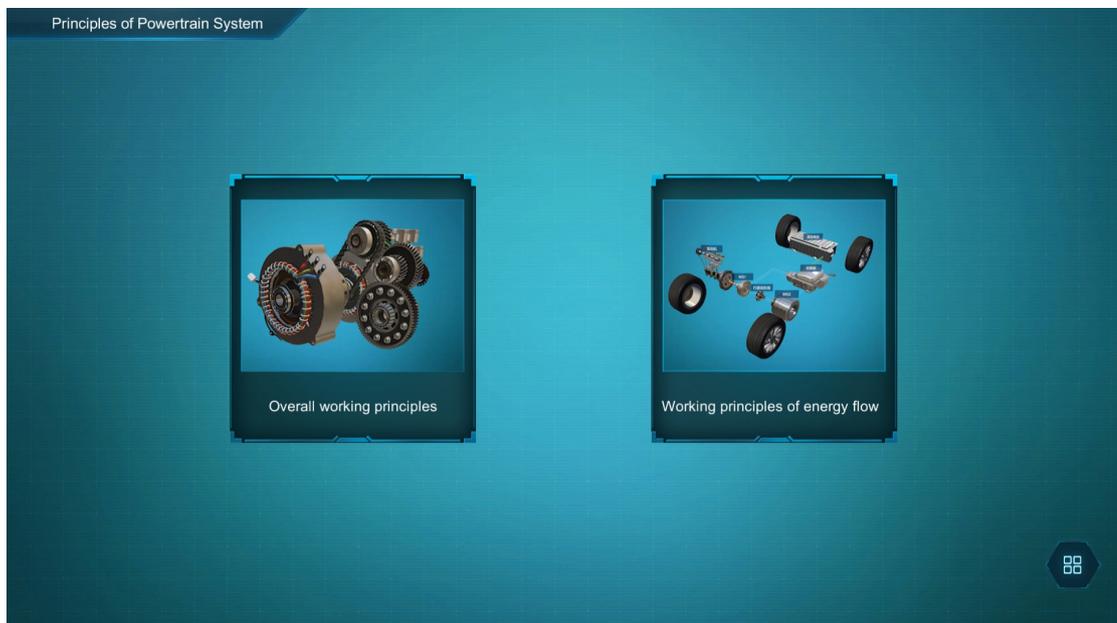


Figure 4-2-13-1 Main interface of working principles of powertrain

1. Press the middle button of the stylus to select "Overall working principles" or "Working principles of energy flow" to enter the corresponding interface.
2. All operations of overall working principles are the same as that of transaxle principles (see 4.2.10).
3. See figure 4-2-13-3 for working principles of energy flow. Press the middle button of the stylus to select the "Start", "Idle", "Low Speed Driving",

“High Speed Driving” , “Energy Recovery” , or “Reverse” in the right for corresponding demonstration.

4. Press the middle button of the stylus to select the "Pause" button in the bottom left corner to pause the animation. (After click, the "Pause" button will change into the "Play" button. Click on the button again to continue to play).

5. Press the middle button of the stylus to select the model, and drag, rotate and zoom in/out. Press the right button of the stylus to select the model, and drag it back and forth to zoom in/out. Press the left button of the stylus to restore the model to its original position.



Figure 4-2-13-2 Overall working principles page

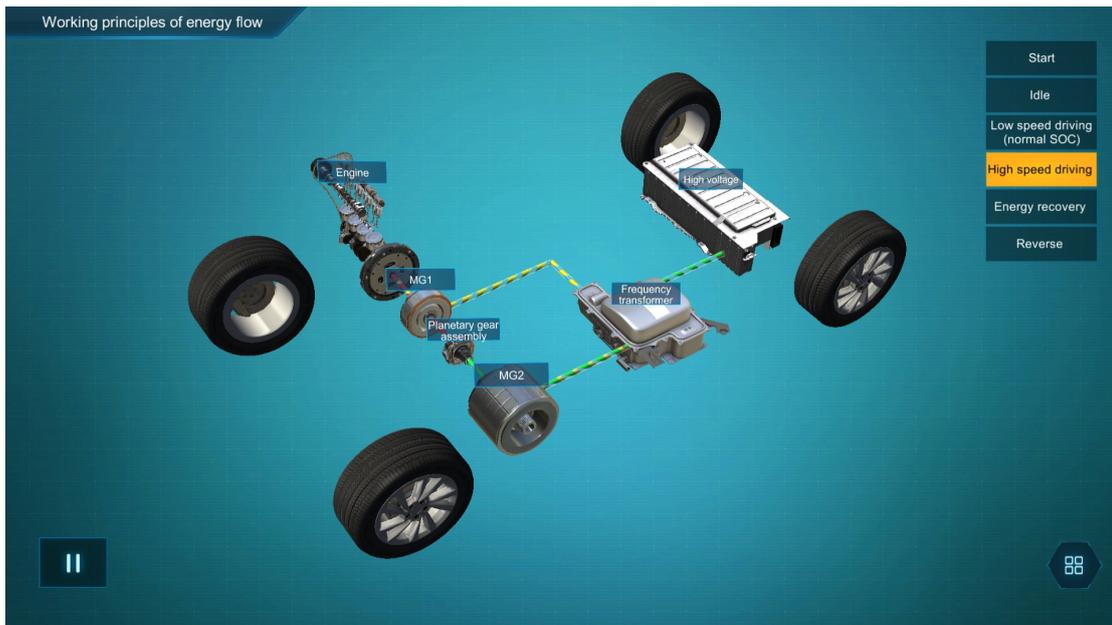


Figure 4-2-13-3 Working principle of energy flow page

"Pause" button-click to pause the animation

## 5. Application Notes

Q1: If the registration code or license key is either non-adaptive or incorrect, the license request failed.

A: reapply for the license or fill in correct code according to the tips.

Q2: Abnormality occurred in the runtime, such as abnormal startup or result

A: Reinstall or repair the program