# Virtual Auto Expert

## V2.1.1

### User and Customer Support Guide

Shenzhen GTA Education Tech Ltd.

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# 1. Introduction

## 1.1. Objective

This manual provides installation and operation instructions for users of Virtual Auto Expert V2.1.1.

## 1.2. Background

1. The software is named Virtual Auto Expert V2.1.1.

2. The software is released by Shenzhen GTA Education Tech Ltd. and developed by its 3D Production Development Center. The software is to be used on zSpace devices.

3. The software comprises a foreground display system and background courseware system. The foreground display system includes the structural display and principle teaching of modules such as engine, clutch, transmission, drivetrain system, wheel and axle, suspension system, steering system, and brake system, body, body-related electrical apparatuses and others, basic circuit elements, and lighting system. The background course builder enables users to compile courseware as their needs.

4. The software application provides online registration. Users can activate the application with the provided activation keys, and then directly enter the software operation interface for operation. The software must be operated on zSpace devices.

5. The software can also use naked eye 3D or zView for better teaching results.

# 2. Purpose

## 2.1. Function and Features

Compiled according to courses from mainland China, the software includes the following modules in the current version.

| Name | Description | |
|---|---|---|
| Engine | General Introduction to Engine | • Working principle of 4-stroke engine, 4-stroke diesel engine, and 4-stroke gasoline engine<br>• Technical terms of engine (piston stroke, top / bottom dead center, compression ratio, cylinder volume, total cylinder volume, and clearance volume)<br>• Multi-cylinder engine (in-line engine, v engine, boxer engine, and w engine) |
| | Engine Block Assembly / Crank and Connecting Rod Mechanism | • Cylinder liner (wet and dry)<br>• Oil sump<br>• Cylinder head<br>• Cylinder head gasket<br>• Load of crank and connecting rod mechanism (gas force and reciprocating |

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| | | inertial force)<br>• Shapes of combustion chambers of engines (wedge-shaped, basin-shaped, and hemispherical)<br>• Piston rings, including compression ring (taper-face, keystone, rectangular, and hooked) and oil ring (bevelled-edge oil control ring and bevelled-edge oil control ring with expander)<br>• Cylinder block (general, gantry, and tunnel)<br>• Piston and connecting rod assembly (piston and connecting rod assembly, piston, connecting rod, and disassembly of piston and connecting rod )<br>• Crankshaft flywheel assembly (crankshaft and flywheel assembly, crankshaft, and flywheel) |
| | Valve Mechanisms | • Valve Clearance<br>• Principles and parameters of valve |

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| | | mechanism<br>• Camshaft arrangement (overhead, middle, and bottom)<br>• Camshaft drive arrangement (gear drive, chain drive, and belt drive)<br>• Valve timing diagram<br>• Variable valve mechanism (Toyoda, Honda, BMW, and Audi)<br>• Valve Assembly<br>• Valve Drive Assembly<br>• Valve<br>• Camshaft |
| | Supercharging System | • Mechanical supercharging and turbocharging<br>• Intercooler (structure and working principles) |
| | Cooling System | • Cooling system<br>• Types of cooling system (natural air cooling, forced cooling, water cooling, and radiator)<br>• Structure and types of radiator |

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| | | (cross-flow and down-flow)<br>• Structure and working principles of cooling fan, thermostat, and water pump<br>• Expansion Tank<br>• Cooling control system |
| | Lubrication System | • Lubrication mode (pressure lubrication, splash lubrication, grease lubrication, and mixed lubrication of fuel oil and lubricating oil)<br>• Lubricating oil pump (internal gear oil pump, working principles of internal gear oil pump, external gear oil pump, working principles of external gear oil pump)<br>• Structure of oil filter and oil pump strainer |
| | Ignition System | • Introduction to ignition system<br>• Distributorless ignition system<br>• Ignition coil<br>• Battery<br>• Spark plug<br>• Alternator |
| | Start System | • Structure and working principle of the |

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| | | engine start system and starter |
| | Fuel Supply System | • Fuel supply system<br>• Fuel tank<br>• Fuel pressure regulator<br>• Fuel injector<br>• Fuel rail<br>• Electric fuel pump<br>• Fuel filter<br>• Crankcase ventilation system |
| | Intake / Exhaust System | • Intake / exhaust system<br>• Intake system<br>• Intake manifold<br>• Throttle valve<br>• Air cleaner<br>• Exhaust system<br>• Exhaust manifold<br>• Three-way catalytic converter<br>• Muffler<br>• EGR solenoid valve |
| Clutch | • Structure and working principle of clutch<br>• Dual clutch transmission<br>• Structure and working process of torsional vibration | |

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| | damper<br>• Service condition of mechanical clutch operating device |
| Transmission | • Composition of transmission<br>• Types of transmission structures (hydraulic, two-shaft, and countershaft)<br>• Structure and service condition of synchronizer, transmission control device (self-locking and interlocking), transfer case<br>• Structure and working principle of the hydraulic automatic transmission (structure of fluid torque converter, working principle of fluid torque converter, multidisc clutch, and planetary gear set)<br>• Structure and working principle of continuously variable transmission |
| Drivetrain System | • Brief introduction to automotive drivetrain system<br>• Types of universal joint (non-constant-velocity joint, quasi-constant velocity joint, and constant-velocity joint), drive shaft<br>• Structure and principle of drive axle structure (non-disconnect drive axle and disconnect drive axle)<br>• Structure and working principle of final drive, gear drive |

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| | • Structure and working principle of differential<br>• Structure of half shaft. |
| Wheel and Axle | • Driving system<br>• Steering axle<br>• Wheel alignment parameter (kingpin caster, kingpin inclination, front wheel camber and toe-in)<br>• Wheel structure<br>• Tire types (bias tire, radial Tire, tubed Tire, and vacuum Tire)<br>• Tire wear |
| Suspension | • Suspension structure (independent suspension, non-independent suspension, semi-independent suspension structure, and semi-independent suspension display)<br>• Shock absorber types (mono-tube shock absorber and twin-tube shock absorber)<br>• Elastic element types (leaf spring, coil spring, torsion bar spring, air spring, and rubber spring) |
| Steering System | • Steering system and steering structure<br>• Steering system (manual steering gear and power steering system) |

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| | • Ideal relationship between steering wheels on both sides<br>• Steering gear types (rack and pinion steering, recirculating ball steering, worm gear steering, and worm and peg steering)<br>• Hydraulic power steering system (structure of hydraulic power steering system and principles of hydraulic power steering System)<br>• Steering control mechanism<br>• Steering linkage mechanism<br>• Steering knuckle |
| Brake System | • Introduction to brake system<br>• Drum brake (leading trailing shoe brake, one leading shoe brake, dual leading shoe brake, dual trailing shoe brake, single servo brake, and dual servo brake)<br>• Disc brake (fixed / floating caliper disc brake)<br>• Parking brake<br>• Brake master cylinder<br>• Hydraulic brake |
| Body | • Entire vehicle<br>• Unitized body<br>• Body-on-frame |

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| | • Subframe<br>• Safety belt |
| Body-related Electrical Apparatuses and Others | • Air conditioning system<br>• Air compressor<br>• Airbag<br>• Windscreen wiper (wiper working process, four-bar mechanism, and three-brush wiper motor)<br>• Start-stop system<br>• Coolant temperature sensor (installation location, structure display, working principles, and fault detection)<br>• Wheel speed sensor (wheel speed sensor and working principles of wheel speed sensor)<br>• Air flow sensor<br>• Throttle position sensor<br>• Hall sensor<br>• Electromagnetic sensor<br>• Oxygen sensor<br>• Knock sensor<br>• Supercharging pressure sensor<br>• Accelerator pedal position sensor<br>• Speed sensor |

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| | • Canister solenoid valve |
| Basic Circuit Elements | • Circuit<br>• Working status of circuit (series circuit, parallel circuit, short circuit, and open circuit)<br>• Relay<br>• Permanent magnet motor |
| Lighting System | • Lighting and signal<br>• Common bulb<br>• LED lamp<br>• Halogen lamp<br>• Gas-discharge lamp<br>• Round headlight<br>• Oval headlight<br>• Parabolic headlight<br>• Functional multi-surface headlight |

# 3. Runtime Environment

## 3.1. Hardware Environment

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| **CPU** | Intel Processor<br>500GB Hard Disk<br>8GB RAM |
| **Graphics Card** | AMD FirePro W5170M |

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| **Resolution** | 1080p |
| **Display Size** | 20.5″ H * 11.5″ V, 23.6″ D (52.07 cm * 29.21 cm * 59.94cm) |
| **Rise Time / Fall Time** | Tr: 1.3 ms<br>Tf: 4.3 ms |
| **Power Requirement** | 19 V, 200 W Power Adapter |
| **Hardware Device** | Power Adapter<br>Stylus Pen<br>Polarized Glasses (3D and 2D)<br>Mouse<br>Keyboard |
| **Space Requirement** | Height: 9-15″ (24-39cm)<br>Width: 25″ (64cm)<br>Depth: 10-20″ (27-52cm) |
| **Environment Requirement** | Temperature: 10-35°C<br>Humidity: 10-80%NC |
| **Cables** | USB 2.0-3 Ports<br>USB 3.0-2 Ports<br>Audio Input / Output Port<br>HDMI Port |

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| | Supporting Ethernet Connection<br><br>Operation Pen Port<br><br>DC Power (19V) |

## 3.2. Software Environment

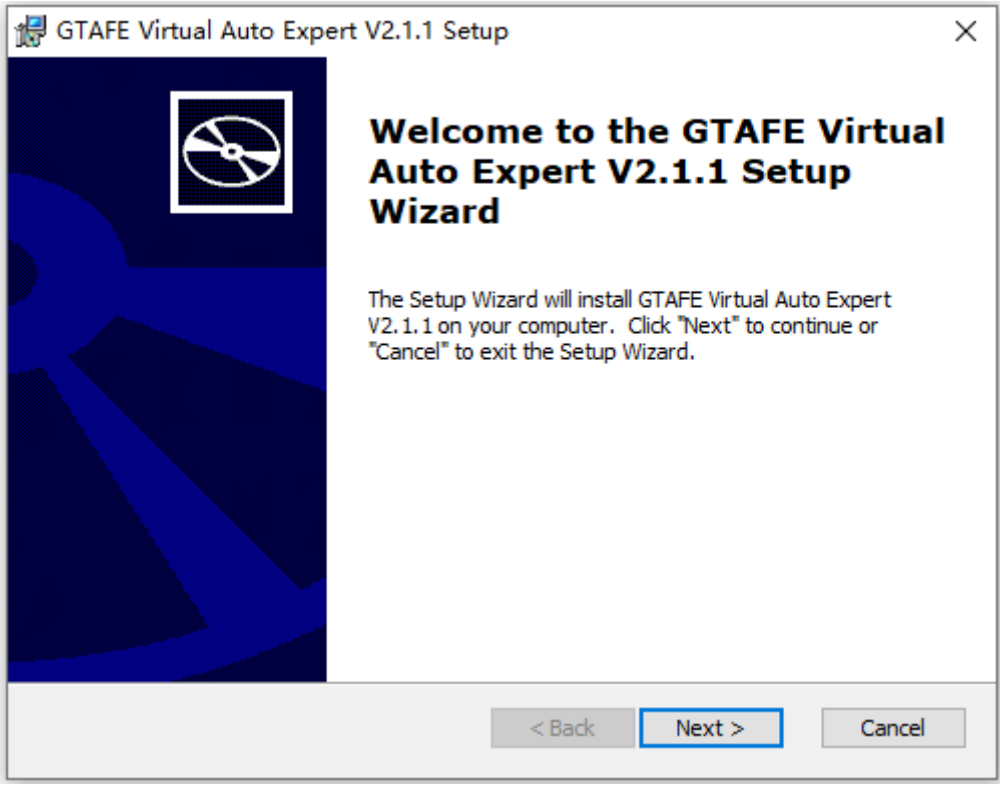
Operating System – Windows 10 (64-bit)

# 4. Operating Instructions

## 4.1. Installation and Initialization

Select 'Start' to enter the software installation interface as shown below.

Select 'Next' to install or 'Cancel' to terminate the installation. Users can continue the installation process according to the operation guide.



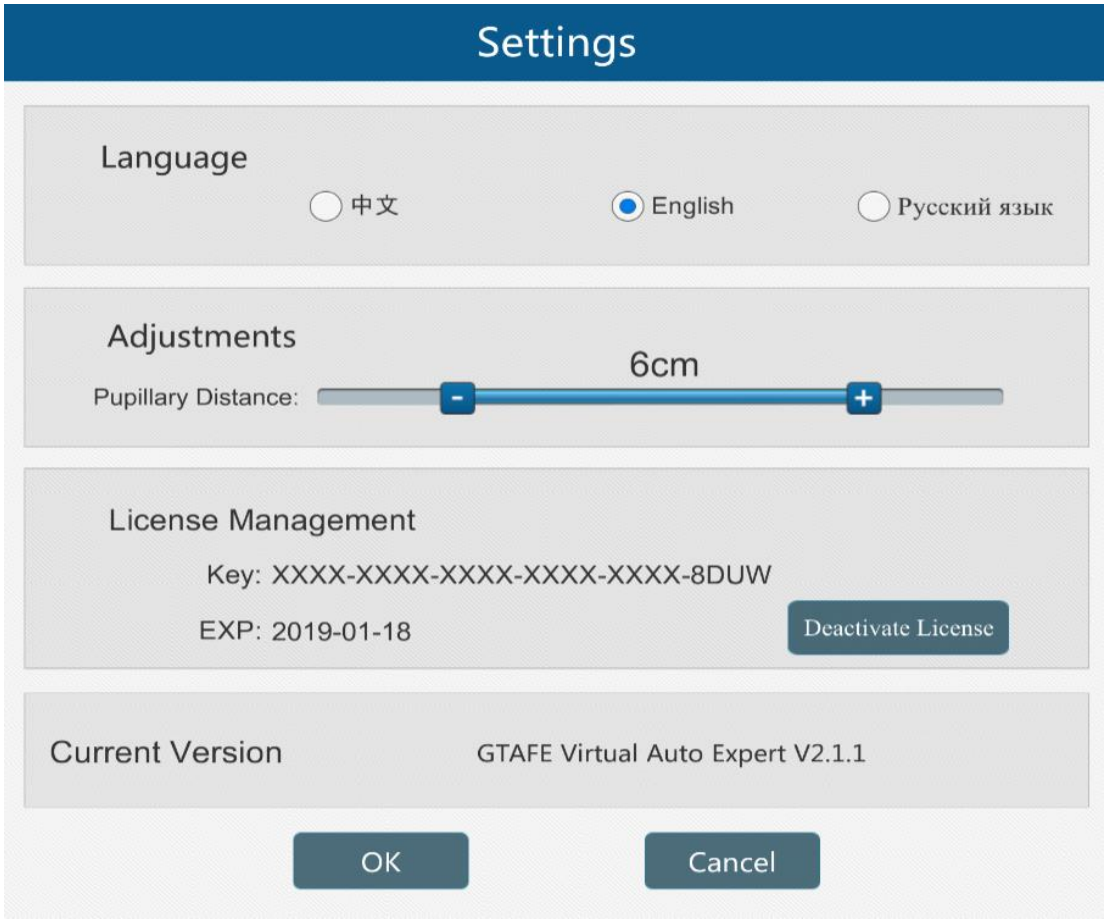
## 4.2. Software Registration

Select the 'Start' icon to enter the software registration interface, and retrieve the product key from the product management center. Enter the product key and select 'Activate License' to start using the software. The registration interface is shown below.


## 4.3. 3D Resources

Enter the initial interface as shown below after the registration. The current interface displays the 3D resource list. Users can operate the corresponding options in the system by clicking the left mouse button or pressing the middle button of the active stylus according to their operating habits.


Select  to enter the "Settings" interface shown below.



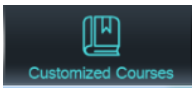

User can select language and adjust the pupillary distance (6cm is default).

Click  to exit the current application.

Select  to enter the zView display interface (connect the zView camera first).

Select  to enter the naked eye 3D display interface (connect the naked eye 3D device first).

Select 

, 

or 

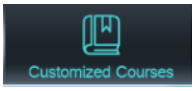
to enter the corresponding interface.

Select the corresponding automotive assembly option and enter the resource display interface as shown below. The operating tool is limited to the active stylus in this functional interface.

Press the middle button of the active stylus to drag and spin VR modules. Press the right button of the active stylus and drag VR modules in and out of the screen to zoom in and out. Select 

to return to the previous menu and select other functional buttons to utilize their corresponding functions.

## 4.4. Customized Courses (Featured Courses)

Select 

to enter the course interface, where users can use 'Import' to import important resources. As Shenzhen GTA Education Tech Ltd. provides customized course development, users can select a course resource package conforming to their specific teaching requirements.

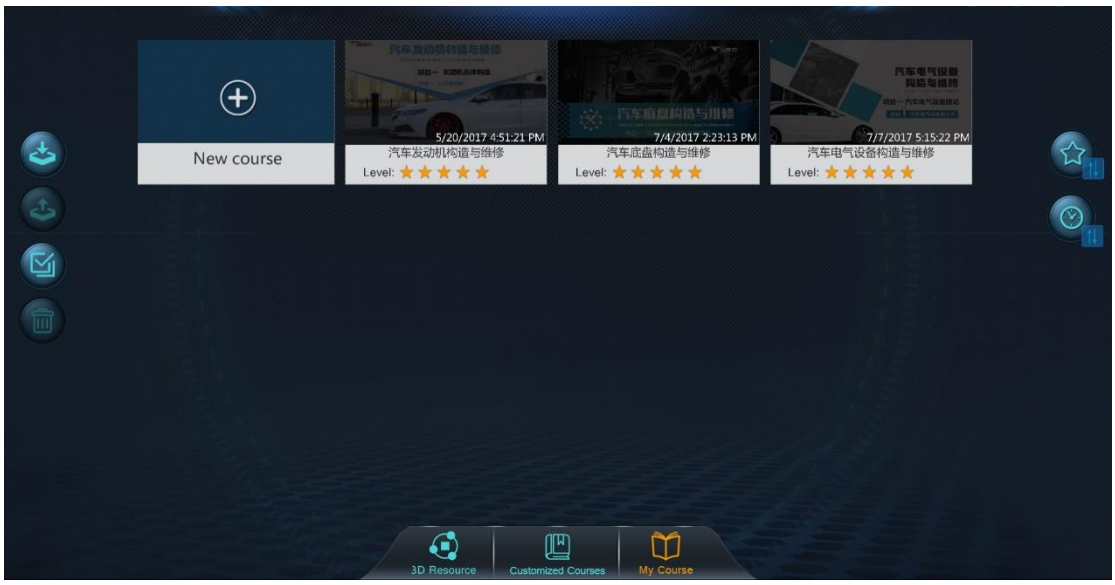

Select  to import VR courseware (courseware is limited to edited courseware on the Virtual Auto Expert). Select  to select all courseware in the current interface. After selecting the corresponding courseware, select

 to delete the corresponding courseware; select  to arrange courseware according to grade level. Select  to arrange courseware in the order of time.

## 4.5. My Course

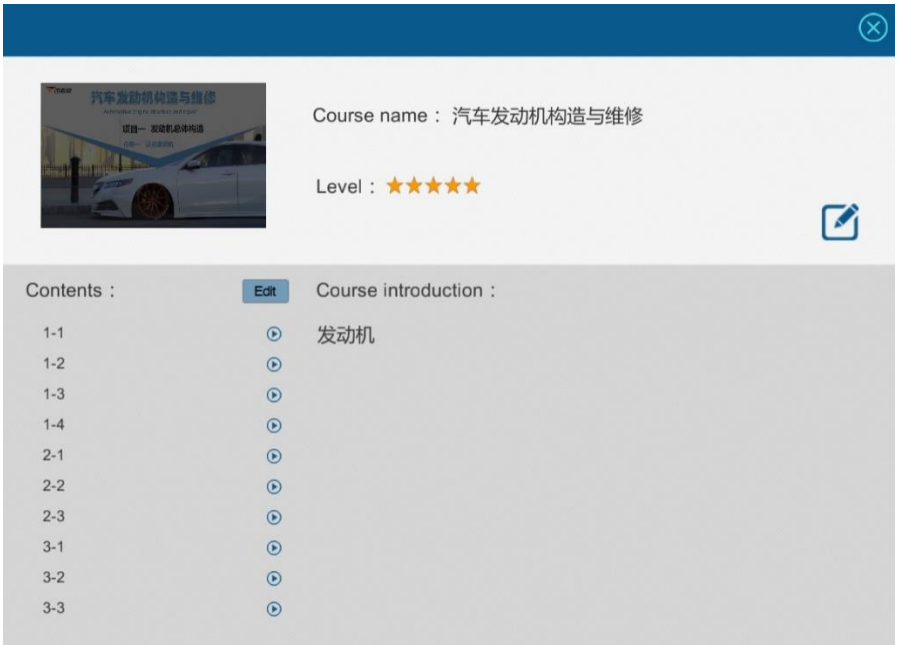
Select 

to enter the My Course interface. Users can find previously edited courseware and/or edit all courseware.

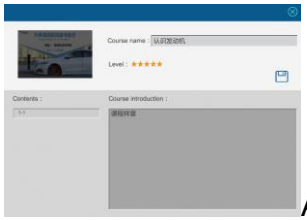



Select  and select the courseware. Select  to export the courseware. Other options have been introduced in the My Course interface, so they will not be elaborated on here.

Select the corresponding course within the interface or select 'New Course' to enter the course editing interface as shown below. Users can edit course information.

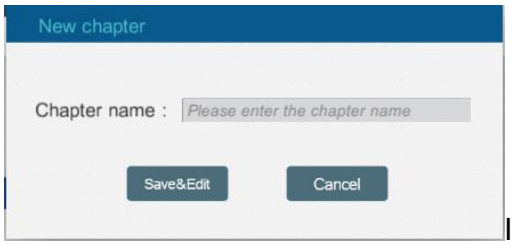



Select  to enter the course information-editing interface as shown below.


All information can be Fedited. After editing, select 

to save the edited information.

Select  to enter the "New chapter" interface as shown below.

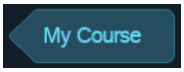


In here, course catalogs can be added.

Select 

to enter the Contents interface 

in which course chapters can be edited. Select the corresponding catalog name to enter the course-editing interface as shown below.


Select 

to return to the previous interface. Select 

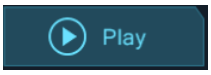
to import edited PowerPoint images. The image name must be a number, so that the system can place the images automatically in order.

Select 

to insert 3D resources. Users can select the resources they want. After inserting, resources can be moved and/or zoomed in or out in the PPT editing interface.

Select 

to insert pictures, flashes, and videos from the local computer.

Select 

and the currently edited courseware can be played.

Select 

to store the courseware.

# 5. Application Notes

1. After the software is registered, a TXT file will be generated on the desktop, which contains the password for deleting Customized Courses. The administrator should keep this file properly.

2. Stylus is available for opening and editing my course, but unavailable for playing the courseware.