

Curriculum Outline

Theme	Category	Task	Description	Time	Act.	Lesn.
Project 0 BeeCar system	Foundation	Video Intro	BeeCar Lessons target	10'		1
		Knowledge	BeeCar background knowledge	10'		
		Hardware	System: Understand Modules and Components	20'		
		Software	Basic Settings in software, flow chart and sequence	20'		
		Activity	The first time to operating the Code process	20'		
Project 1 LED Indicator /Distance Sensor	Game1: Animal Game	Gaming Rule Introduction		10'	1	
		Video and Demonstration		30'		
		Start the game		40'		
	Function Module- LED	Knowledge	LED applications in common life	15'		2
		Hardware	Assembly of LED Indicator	5'		
		Video1	LED Video1: Setting the On/Off mode	5'		
		Software Intro	LED Module- Application of On/Off mode	15'		
		Coding& Logics	Delay time	10'		
		Hands-on1	Experiment to set LED indicator (Demonstrations1-1)	30'		
		Video2	LED Video2: Dimmer	5'		3
		Software Intro	LED Module- Application of Dimmer mode	15'		
		Coding& Logics	Custom Module (Library)	20'		
		Hands-on2	Experiment to set LED indicator (Demonstrations1-2)	40'		
		Video3	LED Video3: Side-to-side	5'		4
		Software Intro	LED Module- Application of Side -to-side mode	15'		
		Coding& Logics	Coding sequence and LOOP	20'		
		Hands-on3	Experiment to set LED indicator (Demonstrations1-3)	40'		
	Test1	Refer to Function Module-LED		80'	2	
	Game2: Bottle Game	Gaming Rule Introduciton		10'	3	
		Video and Demonstration		30'		
		Start the Game		40'		
	Sensing Module- Distance Sensor	Knowledge	Ultra-soic wave principle in common life	15'		5
		Hardware	Assembly Distance Sensor	5'		
		Video1	Distance Sensor Video1: Read Distance Sensor value	5'		
		Software Intro	Distance Sensor Settings	15'		
		Coding& Logics	Read Distance Value	10'		
		Hands-on1	Experiment to read distance value (Demonstrations2-1)	30'		

Project 2		Video2	Distance Sensor Video2: Varies Brightness by distance	5'		6
		Software Intro	Variable and Blank (Variable type)	15'		
		Coding& Logics	LED Dimmer and Variable settings	30'		
		Hands-on2	Set LED Brightness by distance (Demonstrations2-2)	30'		
		Video3	Distance Sensor Video3: Control LED by distance sensor	5'		7
		Software Intro	Geometric Calculation	10'		
		Coding& Logics	Comparison Conditions	15'		
		Hands-on3	Set gradually bright LED (Demonstrations2-3)	30'		
		Hands-on4	Control LED modes by distance (Demonstrations2-4)	30'		
	Test2	Refer to Sensor Module-Distance Sensor		80'	4	
	Motors /Bluetooth	Game3:	Gaming Rule Introduciton	10'	5	
		Push Ball	Video and Demonstration	30'		
		Game	Start the Game	40'		
		Function Module- Motors	Knowledge	Motors principle in common life	15'	8
			Hardware	Assembly Motors Module/Wheels/Battery	10'	
			Video1	Motors Video1: Forward and Back	5'	
			Software Intro	Motors Module settings: clockwise/speed/duration	20'	
			Activity1	Set BeeCar move forward/back (Demonstrations3-1)	30'	9
			Video2	Motors Video1: Differential Speed applications	10'	
			Software Intro	How to set differential speed	10'	
			Activity2	Set BeeCar move right and left (Demonstrations3-2)	30'	
			Activity3	Trace by differential speed settings (Demonstrations3-2)	30'	
		Test3	Refer to Function Module-Motors		80'	6
		Function Module- Bluetooth	Knowledge	Bluebooth principle in common life	15'	10
			Hardware	Bluebooth Module	5'	
			Video1	Bluebooth Video1: receive Chars from Mobile phone	10'	
			Software Intro	Setting of Bluebooth Module	10'	
			Coding& Logics	Read Chars from Bluetooth	10'	11
			Hands-on1	Read Bluebooth Signals (Demonstrations4-1)	30'	
			Video2	Bluebooth Video2: Bluebooth Control Motors by Chars	10'	
			Software Intro	Variable and Blank settings (Char type)	15'	
			Coding& Logics	Switch Case & Logics	15'	
			Hands-on2	Adjust BeeCar to move smoothly(Demonstrations4-2)	40'	
	Test4	Refer to Function Module-Bluetooth		80'	7	

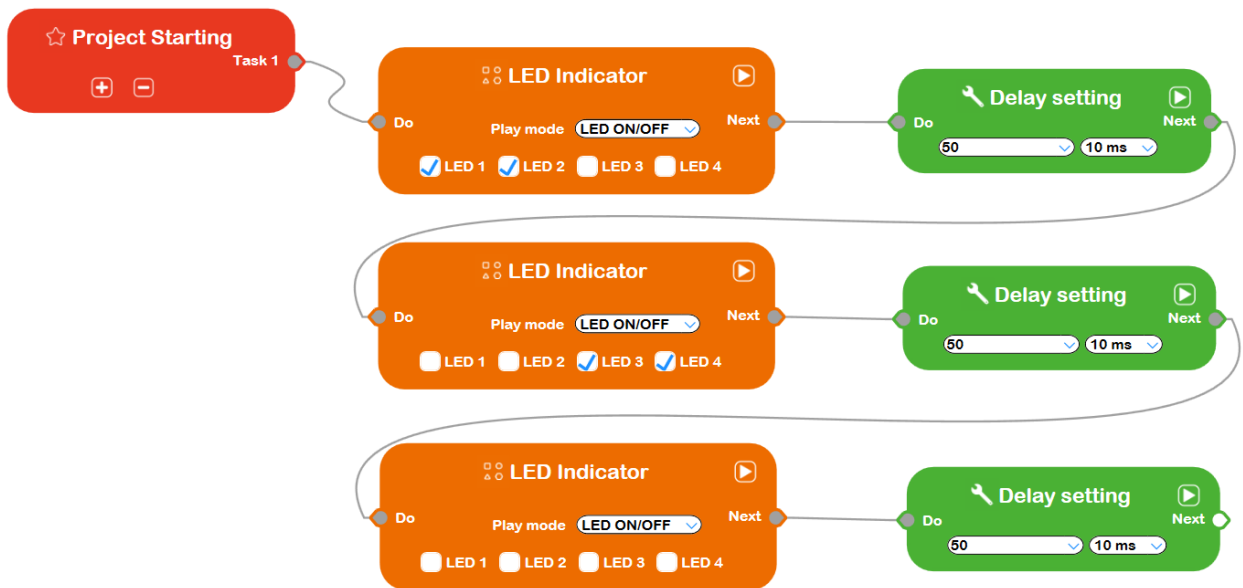
Project 3	Automated Car: Automatic braking	Knowledge	Applications :Forward collision mitigating system (FCM)	5'		12	
		Hardware	Assembly Motors 、 Distance Sensor 、 Bluebooth 、 LED	5'			
		Video1	Automatic braking and distance control	10'			
		Coding& Logics	Set logic by custom module in all directions of Motors	20'			
		Activity	Simulate a FCM project(Demonstrations5-1)	40'			
	Automated Car: Automatic follow-up	Knowledge	Applications : Adaptive cruise control (ACC)	5'		13	
		Video2	Automatic follow-up control	10'			
		Coding& Logics	Set ACC logic by custom module in all directions	25'			
		Activity	Simulate an ACC project(Demonstrations5-2)	40'			
	Test5	Refer to Automated Car: 1			80'	8	
	Test6	Refer to Automated Car: 2			80'	9	
	Final Activity	Group activity + Task description			10'	10	
		Everyone share an idea			15'		
		Brainstorming and Combine the functions together			15'		
		Demonstrate the result			40'		
					Act.	Lesn.	
sum					10	13	

Lesson 1 (Basic Introduction)

Teaching Program		Project 0 --- BeeCar Basic Introduction				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	Let the trainees learn to write programs and understand the relevant hardware and assembly through the process of knowing BeeCar.				
	Teaching Objectives	1. Understand the background history and applications of BeeCar. 2. Know the hardware used in BeeCar (such as LED, sensor, Bluetooth wireless remote control, etc.). 3. Learn how to burn a program.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Functions and operation of programming tool P-III-1. 2. Basic applications of programing tool P-III-2. 3. Basic functional operation of common system platform S-III-1. 4. Application principles of information technology H-III-2.				
	Teaching Preparation	1. BeeCar related videos. 2. BeeCar hardware modules. 3. PPT (software introduction).				
Teaching Activity	Specific Objectives		Teaching Activity		Time	Teaching Resources
	Know the learning objectives of the course through the video.		Video introduction		10'	BeeCar video
	Trigger the trainees' desire for knowledge through introducing the background knowledge of BeeCar.		Knowledge introduction		10'	PPT (BeeCar introduction)
	Let the trainees know the system composition of BeeCar through module demo, and actually let them learn about the hardware disassembly and assembly.		Hardware introduction		20'	BeeCar module
	Introduction to the basic software setting and the flowchart sequence, letting the trainees understand the entire learning process and principles in advance.		Software introduction		20'	PPT (software introduction)
	Let the trainees actually operate the burning program to understand the software operation.		Activity		20'	Several modules
	Guidance essentials and precautions.		1. When disassembling the hardware, the trainees should pay attention to the order and direction of disassembly.			
	Appendix					
	Appendix I Background introduction + PPT (hardware introduction)					
	Appendix II Software introduction --- basic settings and PPT (flowchart)					

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Learning Objectives	Learning objectives of BeeCar course: Let the children contact with graphical programming software when they are young, and nurture the children's logical thinking capability and the ability to solve difficulties using an easy-to-understand learning approach while playing.	10	No video introduction at the moment
Knowledge Introduction	Introduction to the origin of BeeCar: The idea is based on the creation of Volkswagen Beetle. Ferdinand, the founder of Beetle thought that designing a budget car that everyone can afford is the most important thing he should do as compared with the luxury cars. His idea was finally supported by the German government in the 1930s and got what he wished for to build the Beetle. The successful sales of Volkswagen Beetle cars have made Beetle a well-known name. Hence, Beetle is the prototype thinking of BeeCar.	10	※Teaching slideshow P.5
Hardware Introduction	1. First introduce the hardware device: BeeCar is an assembly of a motherboard module, LED indicator module, distance sensor module, motor module, Bluetooth module plus battery, and a body shell. 2. The corresponding positions of the modules with the motherboard module are: 0 for distance sensor; 1 for Bluetooth; 5 for LED; and 9 for motor + power source. 3. The modules and the motherboard are connected by FC cables. 4. Then actually disassemble and assemble the assembly once (the intervals between the modules are secured with hook-and-loop tapes) (the car's mobile power is the battery, supplying the power for the motherboard and motor modules).	20	※Teaching slideshow P.6~P.9 ※Preparation: all components of BeeCar
Software Introduction	1. This is the software screen of our TarkusVP. 2. You need to activate the TarkusVP software in a networked environment by inserting the expansion board to log in or click on login to test using it. 3. Click on the icon → insert the expansion board to log in automatically → select the course topic (classified into motor category, sensor category, sound category, and lighting category). BeeCar is classified in the the motor category → then click on the graphics toolbar. 4. Software interface description [graphics toolbar, file/burning toolbar (same as the general document processing), playback panel, view paging mode, hardware information, browse window (screen resolution adjustment), and software messages.]	20	※Teaching slideshow P.10~P.16 ※Preparation: computers and all components of BeeCar
Burning Program	The first burning program - burn a flashing light and then allow the students to try burning it by themselves (The flashing light will be explained in detail in the 1 st LED lesson. Please refer to the diagram).	20	※Preparation: computers and all components of BeeCar



Lesson 2 (Animal Game)

Teaching Program		Project 1: LED Distance Sensor---Functional Component LED (Animal Game)				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	Let the trainees understand how to operate the LED panel and set the light numbers through the game, and train them to think and apply logically.				
	Teaching Objectives	1. Understand what an LED light is. 2. Understand the LED light control panel. 3. Know what an LED module is. 4. Let the trainees follow the rules of the game, train their logical thinking, learn to set the light numbers orderly, and actually operate with the control panel. 5. Develop the ability to cooperate with others to create using the information technology.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Functions and operation of programming tool P-III-1. 2. Basic applications of programming tool P-III-2. 3. Display method of digital data D-III-2.				
	Teaching Preparation	1. Game teaching video. 2. PPT description. 3. LED modules.				
Teaching Activity	Specific Objectives		Teaching Activity		Time	Teaching Resources
	Explore the principles of LED through the game.		Rules description		10'	PPT teaching
	Understand the LED module through demo teaching.		Video + demo match		30'	Teaching video
	Train logical thinking ability and skillful operation of module interface through the actual game practice.		Practice (playing the game)		40'	1. Several LED modules 2. Several referees and scorers
	Guidance essentials and precautions.		1. Guide the trainees to operate the LED module correctly. 2. Staff members are required to pay attention if the game process complies with the rules of the game. 3. Referees and scorers are required to assist in scoring.			
	Reference 1. https://v.youku.com/v_show/id_XMzY2NjAyNzI4NA==.html?spm=a2h3j.8428770.3416059.1 2. PPT teaching					

	Appendix: Appendix I The game rules of Animal Game 1. Based on the LED template operation mode, both parties need to set 10 groups of players orderly. * The game is continuously set with 10 circulating light numbers: Each light will light up for 1 second. To activate light circulation, use the distance sensor to detect the obstacles. Allow both parties to start the light circulating mode simultaneously. 2. At the beginning of the game, both parties press the Start button to fight against each other orderly. 3. The elephant wins the orangutan, the orangutan wins the kitten, the kitten wins the mouse, and the mouse wins the elephant. 4. The referee judges the light circulating numbers every second when it is started, and the winning party gets 1 point. 5. In case of a cross-order (such as the elephant fighting against the kitten), or fighting against the same players (such as the elephant fighting against the elephant), it is a tie and no score is counted. 6. After a round of 10 sets of fighting, the referee will calculate the points, and the party with the higher scores wins.
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Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Opening Match	Now let' s play the game first. Start to explain the rules of the game: 1. The two parties first set 10 groups of players orderly. 2. At the beginning of the game, both parties press the Start button to fight against each other orderly. 3. Each light number represents an object: (LED1_elephant), (LED2_orangutan), (LED3_cat), (LED4_mouse). 4. The elephant wins the orangutan, the orangutan wins the kitten, the kitten wins the mouse, and the mouse wins the elephant. The judge determines the score every second, and the winner gets 1 point. 5. The LEDs are set with 10 light numbers, where each light will light up in turn every second. To activate light circulation, use the distance sensor to detect the obstacles. Both parties activate the circulating mode simultaneously. 6. In case of a cross-order (such as the elephant fighting against the kitten), or fighting against the same players (such as the elephant fighting against the elephant), it is a tie and no score is counted. 7. After a round of ten sets of fighting, the party with the highest scores wins.	10	※Preparation: computers, motherboard modules, LED modules, and distance sensor modules ※After explaining, ask the students which parts they don' t understand.
Video Introduction	Play a demo video to let the students understand the rules of the game better.	5	※Ensure that the students really understand the rules of the game.
Demo Match	Try to play one set of game and ensure that the students really know how to play.	20	
Start the Game	Start the game officially to let the students participate in it enthusiastically.	40	※Understand each student' s situation and ensure that they play the game seriously.

Lesson 3 (LED1)

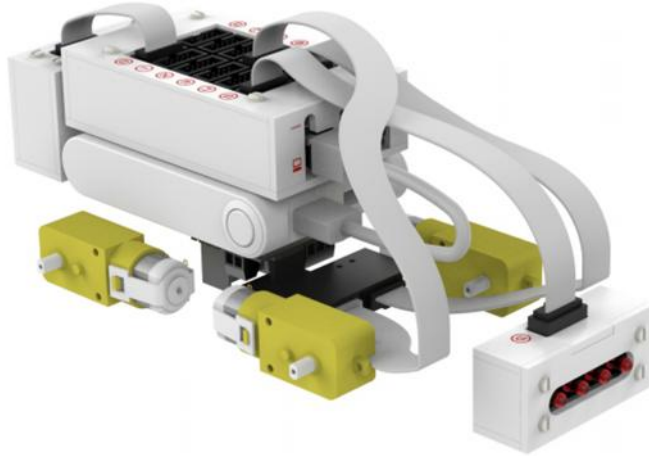
Teaching Program		Projector 1: LED Distance Sensor---Functional Component LED (1st Lesson)					
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education	
Teaching Research	Teaching Philosophy	Let the trainees understand the principles and the life applications of LED, and learn to operate switch mode setting and lighting changes.					
	Teaching Objectives	1. Understand the principles of LED. 2. Know the applications of LED in life. 3. Understand the LED module and connection method. 4. Understand the light number setting of switch mode through the video. 5. Learn about the applications of LED software block and switch mode. 6. Learn about the program command --- delay time. 7. Learn to adjust the LED lighting changes personally.					
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Operation and applications of video editing software T-III-7. 6. Application principles of information technology H-III-2.					
	Teaching Preparation	1. PPT (LED introduction). 2. Hardware device of demo LED module. 3. LED teaching video---switch mode setting of light numbers. 4. PPT (LED software block introduction). 5. Program command --- PPT (delay time teaching). 6. Prepare several LED modules for the trainees.					
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources		
	Let the trainees know the principles and applications of LED through PPT description.		LED introduction	15'	PPT (LED introduction)		
	Let the trainees know the LED module and connection method through the actual hardware.		Hardware introduction	5'	Several hardware components and modules		
	Understand the light numbers and setting of the switch mode through the video.		LED teaching video and description	5'	LED teaching video		
	Let the trainees learn to use the software block and apply it to light number setting of the switch mode.		Software block introduction	15'	PPT (software block introduction)		
	Learn to use [Delay Time] program command through the lecturer' s introduction and synchronous teaching.		Program command teaching	10'	PPT (program settings) and synchronous teaching device		
	Let the trainees apply the switch setting and program commands learned in class to adjust the LED lighting changes.		DIY experience	30'	Several instructors and LED modules		
	Guidance essentials and precautions.						
	References						
1. Teaching video --- switch mode setting of light numbers							

https://v.youku.com/v_show/id_XMzY2NTc4MTAxNg==.html?spm=a2hzp.8253869.0.0

2. [LED principles and PPT \(applications\)](#)

3. [Hardware + software + PPT \(program command introduction\)](#) -- switch mode setting of light numbers

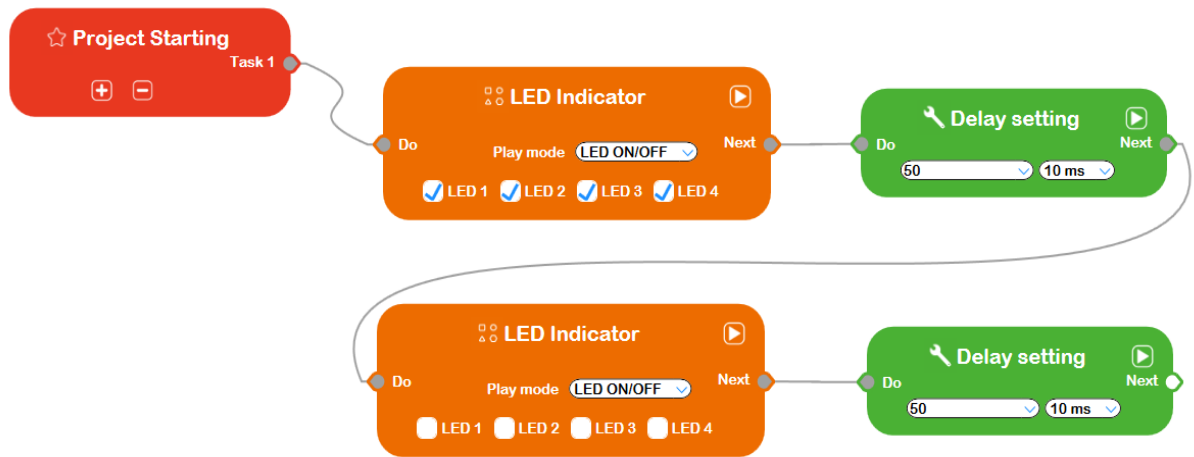
Appendix (finished module)



Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Knowledge Introduction	1. First introduce the background knowledge of LED. Nowadays, there are many LED products in our life, such as various lighting and signal devices installed in today's vehicles to enhance driving conveniences and ensure safety driving. What the lesson teaches in class is a kind of signal device. (Interaction: Ask the students what else around us are using the LEDs? What are their colors?) 2. After Edison invented the light bulbs, people have continued to develop LEDs. 3. As compared with conventional light bulbs, LED is compact in size, has good luminous efficiency and long service life, and does not use toxic substances such as tungsten wire and mercury. 4. LED has become the focus of the green energy industry as it complies with the environmental awareness that everyone is paying attention to now. 5. Many countries, such as Europe, the United States, and Japan are actively involved in the R&D of LEDs. 6. There are many LED colors in our life. Before introducing the principles of LED illumination, first introduce the colors of light. The most common thing in our daily life is white light of the sun, but white light does not appear to be in single color but a mixture of many colors. Then, Newton discovered the refraction of light. 7. After the white light of sunlight passes through a triangular prism, it will disperse into colored lights. It is found that white light is actually a mixture of light in various colors, just like the multicolored pigments in a palette. 8. After the white light is dispersed through the triangular prism and analyzed, it can be arrayed into a "spectrogram" based on light frequencies (or wavelengths). Therein, only the "visible light" can be seen by the human eye. Light energy arrangement: Radio wave < microwave < infrared ray < visible light < ultraviolet light < X-ray < Y-ray. 9. The principle of LED is the addition of more electrons to replace one missing electron, and any two materials have different energy levels. 10. LED applications are divided into visible light and invisible light. Examples of visible light are indoor lighting, information products, brake lights, etc.; and examples of invisible light are medical germicidal light, infrared barcode, etc.	15	※Teaching slideshow P.19~P.24
Module and Connection	1. Explain that the LED module should be inserted in No. 5 slot on the motherboard module. 2. Actually operate it once. 3. After finished assembling, show the schematic diagram to the students.	5	※Teaching slideshow P.25 ※Preparation: LED light modules, motherboard modules, and FC cables ※After explaining, let the students operate once personally.

Video Introduction	Play the LED teaching video 1: Switch mode light setting 1. The time setting part is just a demonstration. You don't have to follow but set the duration according to your preference. 2. As no next move is set here, the LED will light up continuously, which is the concept of the flowchart. After the execution, it will return to the beginning to light up LED1 for 1 second.	5	※Explain while playing to allow the students understand better.
Software Introduction	1. Click on the LED indicator module in the orange block of toolbar. 2. Explain the "light number ON/OFF" mode, tick to indicate turning on this light number (light on continuously).	15	※Teaching slideshow P.27~P.28
Program Commands	1. "Delay setting" introduction: Let the previous module to light on for a while. How long does the setup status last? 2. Then introduce that the arrangement of a program order is: project starts → LED indicator module → delay setting 3. Project starts means to start from the beginning. After executing all the programs, the following program will resume to project starts and replay once more, and repeat again and again.	10	※Teaching slideshow P.29
DIY Experience	1. First demonstrate the LED number plus delay setting (such as the ON/OFF of an LED number): project starts → light up all LED numbers → delay time → turn off all LED numbers → delay time, and then introduce them into the motherboard (as shown in the diagram). 2. Next, allow the students to experience the LED lighting changes.	30	※Flashing lights and news ticker ※Preparation: computers and all components of BeeCar



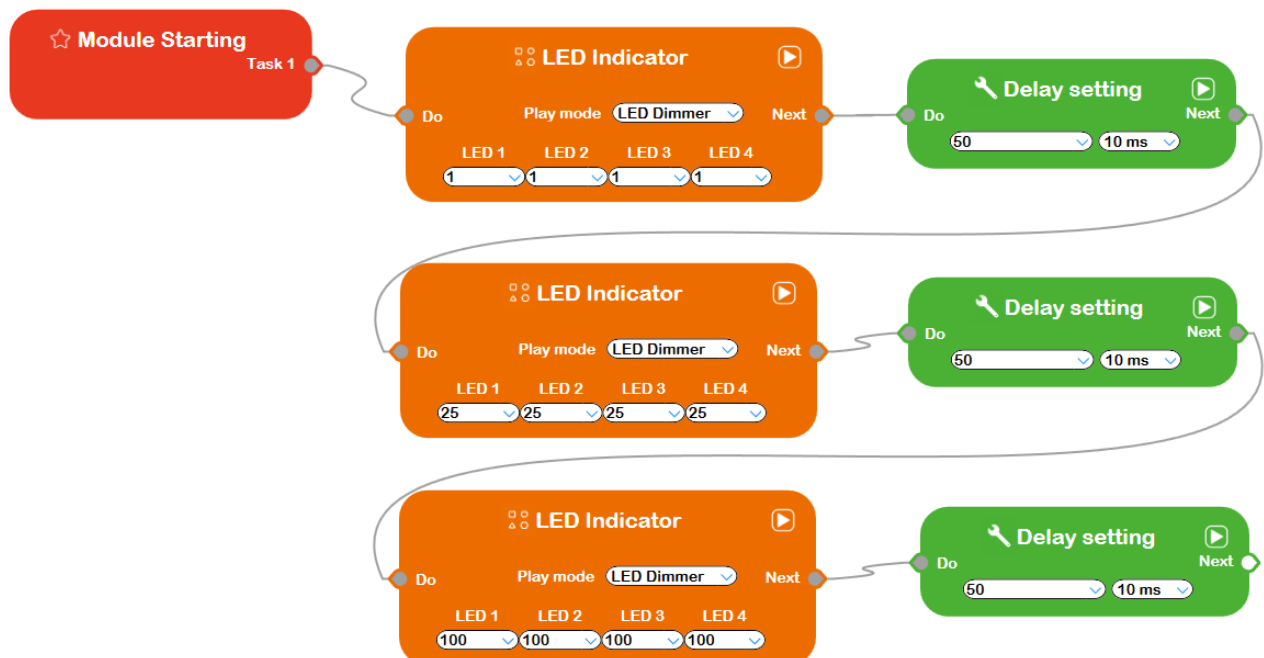
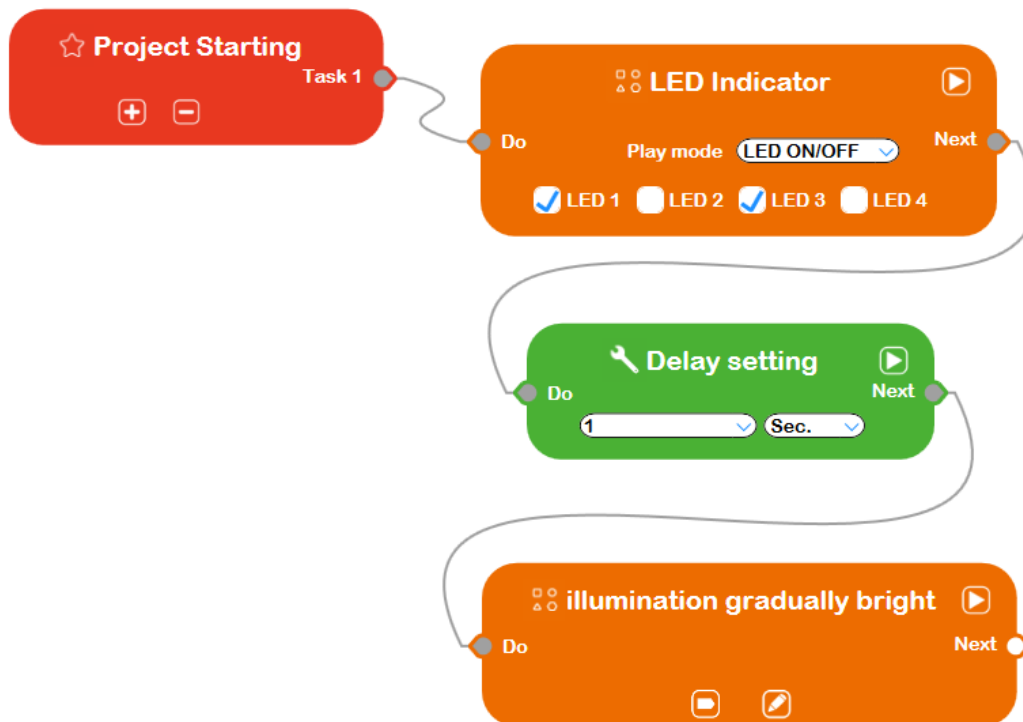
Lesson 4 (LED2)

Teaching Program		Projector 1: LED Distance Sensor---Functional Component LED (2 nd Lesson)			
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study Information Education
Teaching Research	Teaching Philosophy	Apply the concept learned in the 1st lesson to the new software block and dimmer.			
	Teaching Objectives	1. Understand what LED dimmer is. 2. Learn to use the dimmer module. 3. Understand the LED module and connection. 4. Understand the LED dimmer's light number setting through the video. 5. Learn how to use LED software block and dimmer. 6. Learn about the program command --- library. 7. Learn to adjust the LED lighting changes personally.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic concepts, functions and applications of programming language P-IV-1. 5. Application principles of information technology H-III-2. 6. Basic functional operation of common system platform S-III-1. 7. Systematic digital data management method of D-III-3.			
	Teaching Preparation	1. Teaching video --- dimmer light number setting. 2. Software block--- introduction to dimmer mode applications. 3. Program command --- add new module --- PPT (library concept teaching). 4. Prepare several LED lighting modules for the trainees.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Let the trainees learn to set dimmer light number.		LED teaching video appreciation	5'	Teaching video
	Further learn to operate the dimmer module through the software block principles learned in the previous lesson.		Software block – introduction to dimmer mode applications	15'	PPT (software block introduction)
	Learn to use [library] and other program commands through the lecturer's introduction and synchronous teaching, and add in a custom module.		Program command teaching	20'	PPT (program settings) and synchronous teaching device
	Let the trainees apply the switch setting and program commands learned in class to adjust the LED lighting changes.		DIY Experience	40'	Several instructors and LED modules
	Guidance essentials and precautions.		1. Assist the students to use the software block correctly. 2. Guide the students to set up the program commands.		

	References 1. Teaching video --- dimmer light number setting https://v.youku.com/v_show/id_XMzY2NTc5NTEzNg==.html?spm=a2hzp.8253869.0.0 2. Software + PPT (program commands) – dimmer light number setting
	Appendix

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Video Introduction	Play LED teaching video 2: Dimmer light number setting 1. Taillight description 2. Library concept: Throw in more complicated programs to tidy up the messy screen.	5	※Explain while playing to allow the students understand better.
Software Introduction	1. Click on the LED indicator light module in the orange block of toolbar. 2. Explain the “light number dimmer” mode. It can be set in brightness: OFF means 0 brightness, and ON means 100 brightness (maximum brightness). Set the brightness from 0~100 or set the sensor variables, or compute the variables personally (we will make a detailed introduction of the distance sensor variables later).	15	※Teaching slideshow P.32
Program Commands	1. Explain the library concept: To simplify and achieve some of the more difficult computing skills used in a person’ s tasks, such as writing a complex program in the custom module to allow the main screen looks clearer. 2. Explain our software again: Open the orange box in the left toolbar → set a name in the + symbol of the component module (flashing light) and describe. After pressing OK, it will pop up a module, then press  to open a new page and enter into the custom module, set the switch light number and return to the main program screen.	20	※Teaching slideshow P.33~P.36
DIY Experience	1. First demonstrate the LED lighting changes after adding library (as as shown in the diagram). 2. Next, allow the students to experience the LED lighting changes.	40	※Preparation: computers, motherboard modules, LED modules, and FC cables



Lesson 5 (LED3)

Teaching Program		Projector 1: LED Distance Sensor---Functional Component LED (3 rd Lesson)				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	Implement the conceptual applications and software block learned in 1 st ~3 rd lessons to the left-right moving light numbers and lighting changes.				
	Teaching Objectives	1. Learn to use the left-right lighting module. 2. Understand the setting of left-right moving mode of the light number through the video. 3. Learn about the applications of LED software block and left-right moving mode. 4. Learn about the program commands - program ordering and LOOP. 5. Learn to adjust the advanced LED lighting changes personally.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic concepts, functions and applications of programming language P-IV-1. 5. Application principles of information technology H-III-2. 6. Basic functional operation of common system platform S-III-1. 7. Systematic digital data management method of D-III-3.				
	Teaching Preparation	1. Teaching video --- left-right moving light number setting. 2. Software block--- introduction to left-right moving mode applications. 3. Program commands – PPT (program ordering and LOOP teaching). 4. Prepare several LED lighting modules for the trainees.				
Teaching Activity	Specific Objectives		Teaching Activity		Time	Teaching Resources
	Let the trainees learn to set the left-right moving light number.		LED teaching video appreciation		5'	Teaching video
	Learn to operate the left-right moving mode applications with the software block principles learned in the previous lesson.		Software block - introduction to left-right moving mode applications		15'	PPT (software block introduction)
	Learn to use [program ordering and LOOP] program commands to add a new module through the lecturer' s introduction and synchronous teaching.		Program command teaching		20'	PPT (program settings) and synchronous teaching device
	Let the trainees apply the switch setting and program commands learned in class to adjust the LED lighting changes.		DIY experience		40'	Several instructors and LED modules
	Guidance essentials and precautions.		1. Assist the students to use the software block correctly. 2. Guide the students to set up the program commands.			

References

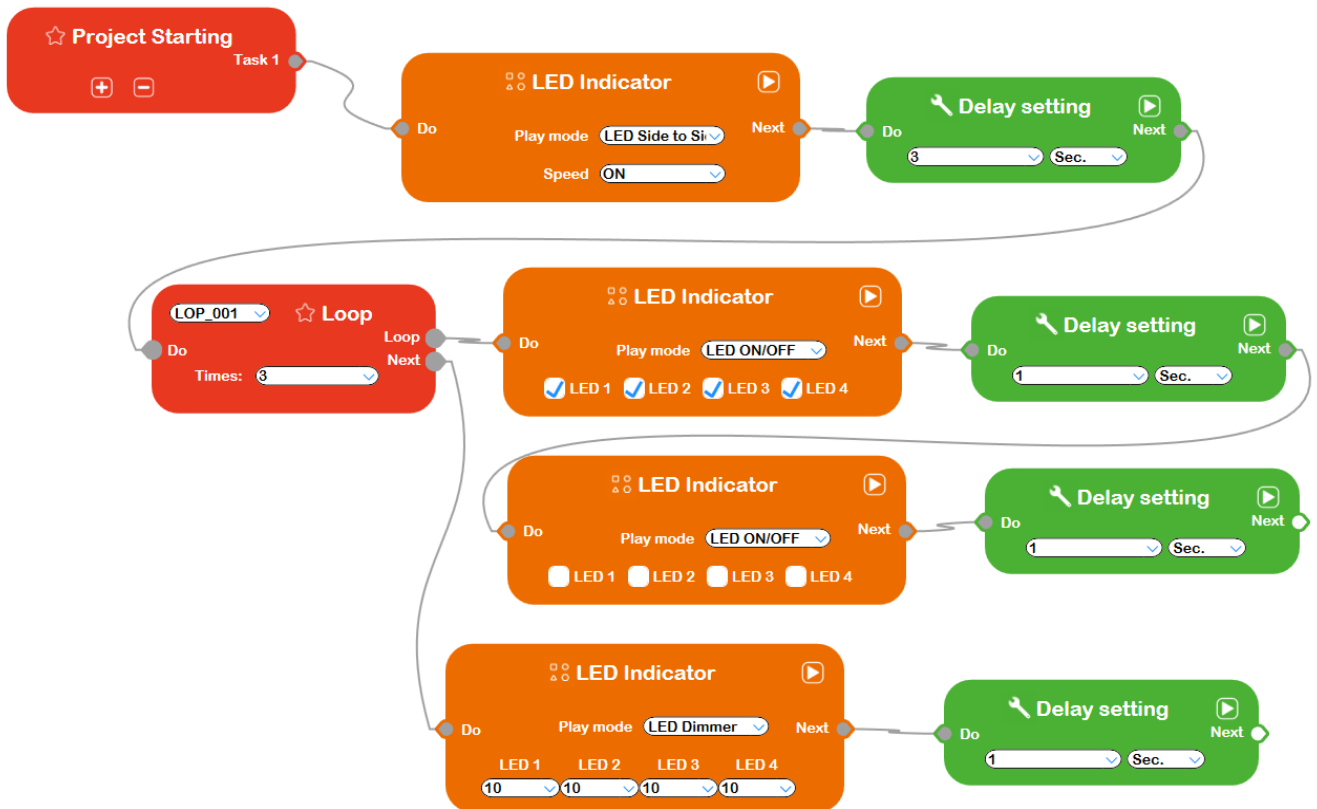
1. Teaching video – left-right moving light number setting
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2. [Software + PPT \(program commands\)](#)

Appendix



Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Video Introduction	Play the LED teaching video 3: Left-right moving LED light setting	5	※Explain while playing to allow the students understand better
Software Introduction	1. Click on the LED indicator module in the orange block of toolbar. 2. Explain the “moving left-right lighting” mode. OFF means to shut down the speed of all light numbers (0), and ON means the flicking speed (100). It can be customized at 0~100, or set as the sensor variables, or compute according to custom variables.	15	※Teaching slideshow P.38
Program Commands	1. Project starts allows to create and execute multiple tasks at the same time, and press  to add in a new task. 2. Loop description: After executing the previous module, repeat the number of loop several times. Fill in the execution numbers in the blank space, or pull the drop-down menu to select the variables. 3. Program ordering description. Project starts → LED indicator light module → delay setting → loop → repeat several times for the following preset light numbers.	20	※Teaching slideshow P.39~P.45
DIY Experience	1. Firstly demonstrate the LED lighting changes after adding LOOP: Project starts → left-right moving LED light number → delay setting for 3 seconds → [loop (3 times) → light up all LED numbers → delay setting of 1 second → shut off all LED light numbers → delay setting for 1 second] → light up all LED numbers in brightness 10 → delay setting for 1 second (as shown in the diagram). 2. Next, allow the students to experience the LED lighting changes personally.	40	※Preparation: computers, motherboard modules, LED modules, and FC cables



Lesson 6 (Advanced Animal Game)

Teaching Program		Project 1: LED Distance Sensor---Advanced Game (Animal Game)				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	1. Let the trainees know how to operate the LED panel and set the light numbers through the game. 2. Train the students think and apply logically. 3. Increase the tension of the game by adding more animal species to enhance the trainees’ logical and operating skills.				
	Teaching Objectives	1. Understand what an LED light is. 2. Understand the LED light operation panel. 3. Know what an LED module is. 4. Let the trainees follow the rules of the game, train their logical thinking, learn to set the order of light numbers, and actually operate the panel. 5. Develop the ability to cooperate and create with others using the information technology.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Functions and operation of programming tool P-III-1. 2. Basic applications of programming tool P-III-2. 3. Display method of digital data D-III-2.				
	Teaching Preparation	1. Game teaching video. 2. PPT description. 3. LED modules.				
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources	
	Explore the principles of LED through the game.		Rules description	10’	PPT teaching	
	Understand the LED module through an advanced demo teaching.		Video + demo	30’	Teaching video	
	Train the logical thinking ability, and operate the module interface skillful through actually playing the game.		Practice (playing the game)	40’	1. Several LED modules 2. Several referees and scorers	
	Guidance essentials and precautions.		1. Guide the students to operate the LED module correctly. 2. Staff members are required to pay attention if the game process complies with the rules of the game. 3. Referees and scorers are required to assist in scoring.			
	References 1.https://v.youku.com/v_show/id_XMzY2NjAyNzI4NA==.html?spm=a2h3j.8428770.3416059.1 2. PPT teaching					
	Appendix: Appendix I The game rules of Animal Game					

	1. Based on the LED template operation mode, both parties need to set 10 groups of players orderly. * The game is continuously set with 10 circulating light numbers: Each light will light up for 1 second. To activate light circulation, use the distance sensor to detect the obstacles. Allow both parties to start the light circulating mode simultaneously. 2. At the beginning of the game, both parties press the Start button to fight against each other orderly. 3. The elephant wins the orangutan, the orangutan wins the kitten, the kitten wins the mouse, and the mouse wins the elephant. 4. The referee judges the light circulating numbers every second when it is started, and the winning party gets 1 point. 5. In case of a cross-order (such as the elephant fighting against the kitten), or fighting against the same players (such as the elephant fighting against the elephant), it is a tie and no score is counted. 6. After a round of 10 sets of fighting, the referee will calculate the points, and the party with the higher scores wins.
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Lesson 7 (The Bottle Game)

Teaching Program		Project 1: LED Distance Sensor --- Functional Component LED (The Bottle Game)				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	1. Let the trainees know how to operate the LED panel and set the light numbers through the game. 2. Train students to think and apply logically. 3. Train students in mathematical computation and digital logic.				
	Teaching Objectives	1. Understand what LED light is. 2. Understand the LED operation panel. 3. Know what an LED module is. 4. Let the trainees follow the rules of the game, train their logical thinking, learn to set the order of light numbers, and actually operate the panel. 5. Develop the ability to create with others using the information technology. 6. Train the students to link and use Information Education with mathematics				
	Teaching Program Corresponding to Segmentation Capability Index	1. Functions and operation of programming tool P-III-1. 2. Basic applications of programming tool P-III-2. 3. Display method of digital data D-III-2. 4. Use N-1-02 to understand the meaning of addition and subtraction to solve the problems in life.				
	Teaching Preparation	1. Game teaching video. 2. PPT description. 3. LED modules.				
Teaching Activity	Specific Objectives		Teaching Activity		Time	Teaching Resources
	Explore the principles of LED through the game.		Rules description		10'	PPT (teaching)
	Learn about the LED module through demo teaching.		Video + demo		30'	Teaching video
	Train the logical thinking ability and operate the module interface skillfully through actually playing the game.		Practice (playing the game)		40'	1. Several LED modules 2. One referee and several scorers
	Guidance essentials and precautions.		1. Guide the trinees to operate the LED module correctly. 2. Staff members are required to pay attention if the game process complies with the rules of the game. 3. A referee and scorers are required to assist in scoring.			
	References 1. https://v.youku.com/v_show/id_XMzY2NjAzMTM5Mg==.html?spm=a2h3j.8428770.3416059.1 2. PPT teaching					
	Appendix: Appendix I The game rules of The Bottle Game					

1. The players first place the sensor at a fixed distance around the venue (77cm from the center).
2. In each round, the players set the attack multiples (1-4 times, one light is equal to double).
3. When starting to attack, the players place the energy column arbitrarily in the field and throw two attack dices in multiples. The number of points on the attack dice added with the numeral on the player' s displayed light number is the attack power.
4. All players need to light up the lights in each attack. If one party does not light up the lights, it is impossible to throw the attack dice. In each attack, each player has three chances of attack.
5. Each player has 96 points. In each round, the points are deducted according to the strength of the attack (you will also be deducted). The player will be eliminated when his/her points are deducted until negative number, and the last one on the field is the winner.
6. When the last deduction point is exactly zero, it is a total switch to become the winner in this game.

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Opening Match	Now let' s play a game first called "The Bottle Game." The rules of the game are as follows: 1. The players first place the sensor at a fixed distance around the venue (77cm from the center). 2. In each round, the players set the attack multiples (1-4 times, one light is equal to double). 3. When starting to attack, the players place the energy column arbitrarily in the field and throw two attack dices in multiples. The number of points on the attack dice added with the numeral on the player' s displayed light number is the attack power. 4. All players need to light up the lights in each attack. If one party does not light up the lights, it is impossible to throw the attack dice. In each attack, each player has three chances of attack. 5. Each player has 96 points. In each round, the points are deducted according to the strength of the attack (you will also be deducted). The player will be eliminated when his/her points are deducted until negative number, and the last one on the field is the winner. 6. When the last deduction point is exactly zero, it is a total switch to become the winner in this game.	10	※Teaching slideshow P.47 ※Preparation: computers, motherboard modules, LED modules, distance sensor modules, car chassis, dice, digital signboard, and energy column ※After explaining, ask the students which parts they don' t understand.
Video Introduction	Play a demo video to let the students understand the rules of game better.	5	※Ensure that the students really understand the rules of the game.
Demo Match	Let the students playing the game once and ensure that they can play it.	20	
Start the Game	Start the game officially to let the students participate in it enthusiastically.	40	※Understand each student' s situation and ensure that they play the game seriously.

Lesson 8 (Distance 1)

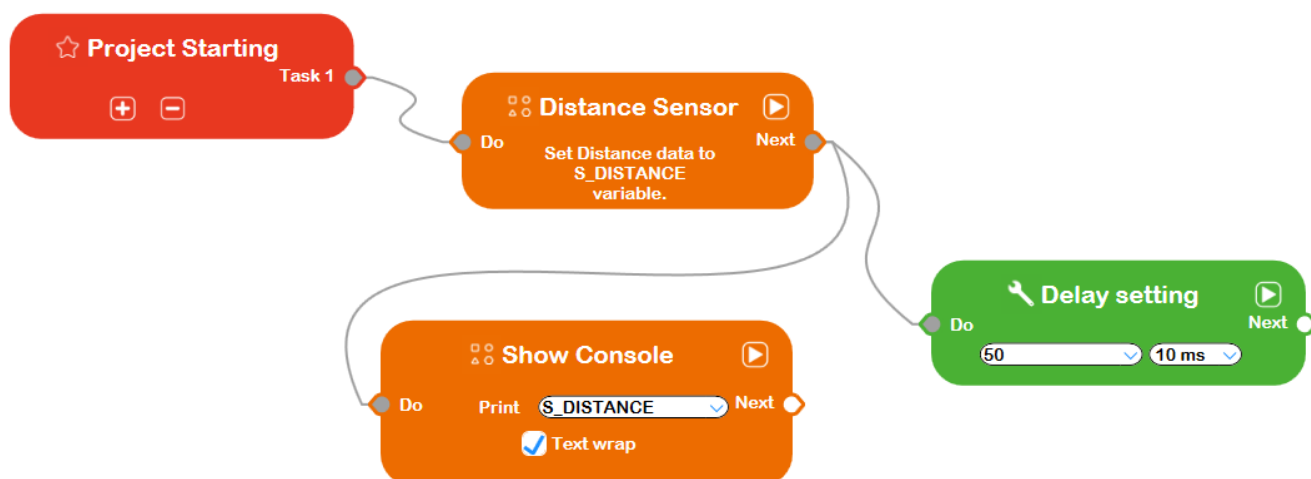
Teaching Program		Projector 1: LED Distance Sensor - Sensing Components of Distance Sensor (1st Lesson)				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	1. Let the trainees understand the principles and life knowledge of ultrasonic. 2. Learn to operate the distance sensor and learn to read the data.				
	Teaching Objectives	1. Understand the principles of ultrasonic. 2. Understand the application knowledge of ultrasonic in life. 3. Understand the distance sensor module and connection method. 4. Learn to read the distance sensor values through the video. 5. Learn about the software block of distance sensor. 6. Learn about the program command - read the block values. 7. Learn to operate and read the distance sensor values personally.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of the programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Modular programming and problem solving practice of P-IV-5. 5. Basic functional operation of common system platform S-III-1. 6. Applicable principles of information technology H-III-2.				
	Teaching Preparation	1. PPT (ultrasonic sensor introduction). 2. Hardware device for demonstrating the distance sensor module. 3. Teaching video - read the distance sensor values. 4. PPT (distance sensor software block introduction). 5. Program command - read the block values. 6. Prepare several distance sensor modules for the trainees.				
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources	
	Let the trainees know the principles and applications of ultrasonic sensor through PPT description.		Introduction to ultrasonic knowledge	15'	PPT (ultrasonic sensor introduction)	
	Let the trainees know the distance sensor module and connection method through the actual hardware.		Hardware introduction	5'	Several hardware components and modules	
	Understand to read the distance sensor values through the video.		Distance sensor teaching video and description	5'	Distance sensor teaching video	
	Let the trainees learn to use the software blocks and apply them in reading the block values.		Software block introduction	15'	PPT (software block introduction)	
	Learn to use [read the block values] program command through the lecturer's introduction and synchronous teaching.		Program instruction teaching	10'	PPT (program settings) and synchronous teaching device	
	Let the trainees read the block values from operating the distance sensor in class.		DIY experience	30'	Several instructors and distance sensor modules	

	Guidance essentials and precautions.	
	References 1. Teaching video --- distance sensor https://v.youku.com/v_show/id_XMzY2NTg1NTU5Ng==.html?spm=a2hzp.8253869.0.0 2. Ultrasonic sensor principles and PPT (applications) 3. Hardware + software + PPT (program command introduction) --- read the block values	
	Appendix (finished module) 	

Teaching steps:

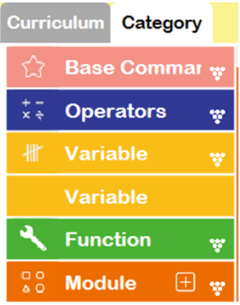
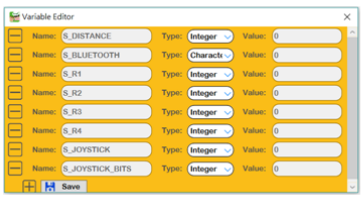
	Teaching Contents	Duration (min.)	Remarks
Knowledge Introduction	1. First introduce the sensor: The car front radar collision avoidance system is a safety auxiliary device for driving, parking, etc. This system is equipped with an imported ultrasonic sensor to detect if there is any obstacle in front of the car. Its principle involves the use of command and control computation of microcomputer system to indicate the direction of the obstacle and the distance between the car body and the obstacle through the sound and display, respectively to prevent collision and ensure everyone's safety. Let say you are in a traffic jam and need to cross on the left or overtake on the right. How far is the vehicle in front of you? What is the safe distance to avoid collision on the congested road? To know this safe distance, you need to install a radar detector at the front (Interaction: Ask the students what else are equipped with a distance sensor?) 2. Ultrasonic wave is used to measure distance. The principle of ultrasonic sensor is similar to the principle of throwing a ball. The sensor's right portion emits a signal in the form of an ultrasonic wave. Upon meeting an obstacle, part of the wave is reflected and the reflected wave is received by the sensor's left portion. The distance between the obstacle and the reflector can be derived based on the time spent during the entire process. 3. Let's take talking as an example. The time taken by the speaker to the listener's ear multiplied by the distance traveled per unit time (the speed of the sound at room temperature is 340 meters per second) is equal to the total span of sound wave transmission, i.e., the distance. 4. How can you calculate the distance between the car and the obstacle in front of it? When the car is moving forward, the ultrasonic wave also moves from the original position to the current position of the car (receiver) after the car has traveled a certain distance. From this picture (slideshow P.59), we can later know that the distance between the car and the obstacle can be calculated as (as shown in the slideshow): the distance traveled by the untrasonic wave – the distance traveled by the car = 2 X (the later distance between the car and the obstacle) (wave speed - car speed) X time difference = 2 X (the later distance between the car and the obstacle). Then the time difference and the car speed can be measured by an instrument, and the speed of the sound wave is 340 meters per second. 5. Ultrasonic sensor uses "ultrasonic wave" as the signal to transmit and receive. What is ultrasonic wave? Ultrasonic wave, also known as ultrasound wave, is a kind of sound wave that is inaudible by the human ear. The higher the pitch, the higher the "frequency" is, and the range that people can hear is frequency 20~20000Hz. The sound exceeding 20,000Hz is called ultrasonic wave. The frequency range that each animal can hear varies. For example, we can't hear the sound that the fish can hear.	15	※Teaching slideshow P.49~P.53
Module and	1. Explain that the distance sensor module should be inserted in No. 0 slot	5	※Teaching slideshow

Connection	on the motherboard module. 2. Actually operate it once. 3. After finished assembling, show the schematic diagram to the students.		P.54 ※Preparation: distance sensor modules, motherboard modules, and FC cables ※After explaining, allow the students to operate once
Video Introduction	Play the distance sensor teaching video 1: Read the distance sensor values 1. S_DISTANCE is the distance sensor variable. 2. Each detection is responded with a returned value. The faster the time setting, the faster the detection is. On the contrary, the slower the time setting, the slower the detection is. 3. There are many distance sensing applications in life, such as the car' s auto stop system, auto tailgate system, mobile phone, etc.	5	※Explain while playing to allow the students understand better.
Software Introductio	1. Click on the "Distance Sensor" in the orange block of toolbar. 2. When explaining the execution of distance sensor, the module will read the distance value from the sensor component and write it into the system preset variable S_DISTANCE.		※Teaching slideshow P.56~P.57
Program Commands	If you want to see the S_DISTANCE variable value, you can connect to the "Show Returned Message" module (the bottom button found in the left of the orange block), then click on the magnifying glass button on the top file/burning toolbar. When the S_DISTANCE value is seen in the "Returned Message Block," it will display the number according to the distance.	10	※Teaching slidehow P.57
DIY Experience	1. First demonstrate to connect the "Distance Sensor" to "Show Returned Message." After burning, perform an actual operation to let the students see. The nearer the distance, the smaller the value is; and the farther the distance, the larger the value is. 2. Then, let the students experience to read the distance values.	30	※Preparation: computers, distance sensor modules, motherboard modules, and obstacles



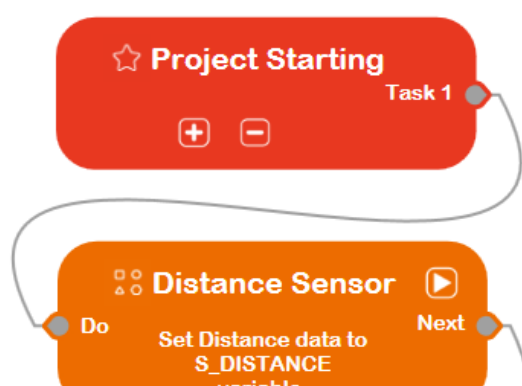
Lesson 9 (Distance 2)

Teaching Program		Projector 1: LED Distance Sensor - Sensing Components of Distance Sensor (2nd Lesson)			
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study Information Education
Teaching Research	Teaching Philosophy	1. Apply the concept learned in the 1st lesson to the new software block. 2. Learn to adjust the brightness of LED with the distance sensor.			
	Teaching Objectives	1. Understand the LED dimmer. 2. Learn to use the dimmer module. 3. Understand the LED and distance sensor module, and the connection method. 4. Understand how to adjust the brightness of LED with distance changes through the video. 5. Learn about the LED software block --- variables and field types (numeral type). 6. Learn about the program commands --- LED dimmer + variable setting. 7. Learn personally to test adjusting the LED brightness with distance changes.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic concepts, functions and applications of P-IV-1 programming language. 5. Application principles of information technology H-III-2. 6. Basic functional operation of common system platform S-III-1. 7. Systematic digital data management method of D-III-3.			
	Teaching Preparation	1. Teaching video --- LED light changes its brightness with distances. 2. Software block --- introduction to variables and field types (digital type). 3. Program commands --- LED dimmer + PPT (variable setting teaching). 4. LED lighting and several distance sensor modules for the trainees.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Let the trainees learn to adjust the brightness of LED through different distances.		Teaching video appreciation on LED that changes brightness with distances	5'	Teaching video
	Further learn to operate variables and field types from the software block principles learned in the previous lesson.		Software block --- variables and field types description (digital type)	15'	PPT (software block introduction)
	Learn to use [LED dimmer + variable setting] and other program commands through the lecturer's introduction and synchronous teaching.		Program command teaching	30'	PPT (program setting) and synchronous teaching device
	Let the trainees apply the distance sensor and program commands learned in class to adjust the LED lighting changes.		DIY experience	30'	Several instructors, LEDs and distance sensor modules
	Guidance essentials and precautions.		1. Assist the students to use the software blocks correctly.		

	2. Guide the students to set up the program commands.
References - Teaching video---LED lights that change brightness with distances https://v.youku.com/v_show/id_XMzY2NTg3MjE0MA==.html?spm=a2hzp.8253869.0.0 - Software + PPT (program commands) --- LED dimmer + variable setting (see Appendix I, Appendix II)	
Appendix Appendix I. Introduction to variables and field types (digital type) 3. Variable settings. Variable: A data of number or character. S_DISTANCE: A default variable of detecting distance between sensor and object. (1) Open variable table.  Left side of toolbar. Category > Variable > Variable Appendix II: LED dimmer + variable setting (2) Variable table introduction  Click to add new variable Click to delete variable Variable named. S_DISTANCE is defined by the value of distance from the Object to sensor. For the type of value, you can choose integer or character. Value: To set the initial value of variable. (3) Other variable that will be produced while the base command created: LOP_001	

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Video Introduction	Play distance sensor teaching video 2: LED lights changes its brightness with distances - Variables are numbers or characters that change for some reason. - Adjust the brightness of the light number by the value detected by the distance sensor. - Explain the variable setting table. - The nearer the distance, the darker the light is; and the farther the distance, the brighter the light is.	5	※Explain while playing to allow the students understand better.
Software Introduction	- Introduce that variables are numbers or characters that change for some reasons, and they also change with the status. Next, let's introduce the distance sensor, which can cause other changes with distances, such as changing the LED brightness with different distances. - How do activate the variable setting in the software? Click on the yellow block in the left toolbar → variable setting → variable setting. - After clicking "+," you can add a variable yourself, or "-" to delete the variable, (the first two items are preset by the system and cannot be deleted). Variable name: You can change the name by yourself (also, the first two items are preset by the system and cannot be deleted). S_DISTANCE is the distance value from the obstacle, which can be used to detect the distance and then cause the changes. The type can be chosen in an integer or a character format. Integer refers to as 1, 2, 3, 4, 5, etc., and character as A, B, C, D, E, etc. What about the value? You can preset a value at the beginning. - Other preset variables like LOP_001: When the loop is activated, the system will automatically set this loop as a custom variable. You can change other values or characters in the variable setting to use them as comparison conditions.	15	※Teaching slideshow P.60~P.61
Program Command	Then, the LED dimmer can be combined with the variable S_DISTANCE to design a program that changes the brightness of LED as taught in the video.	30	
DIY Experience	- First demonstrate how to use a program command to change the brightness of LED with distances (project starts → distance sensor → select "light number dimmer" mode in the LED indicator module. Select all four light numbers in S_DISTANCE). Then, it will adjust the brightness depending on different distances. The farther the distance, the larger the value is and the brighter the lighting is. On the contrary, the nearer the distance, the smaller the value is and the darker the lighting is (as shown in the diagram). - Next, allow the students to actually operate it.	30	※Preparation: computers, distance sensor modules, LED indicator modules, and an obstacle ※Guide the students while they are operating to see how well they are doing.



Lesson 10 (Distance 3)

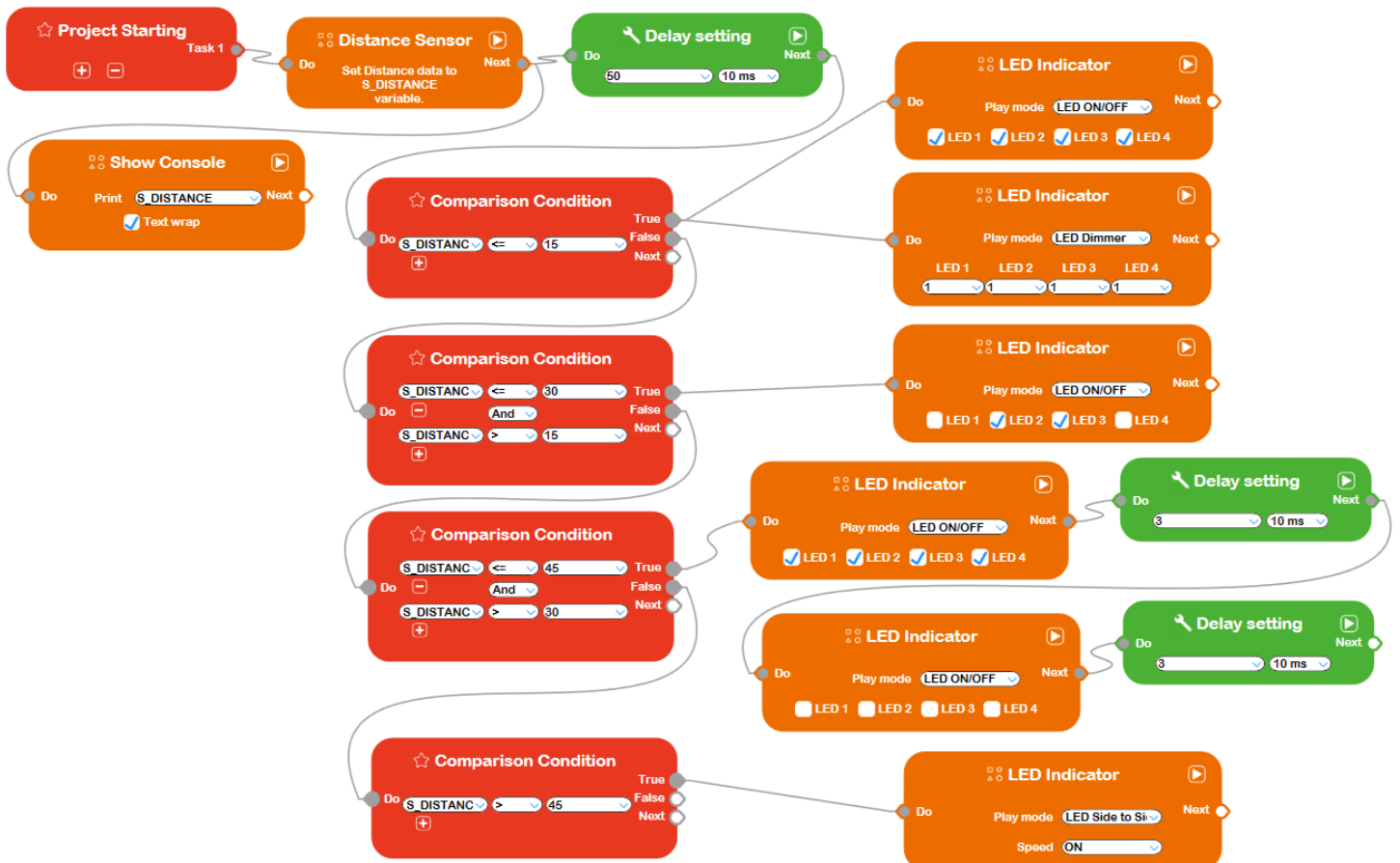
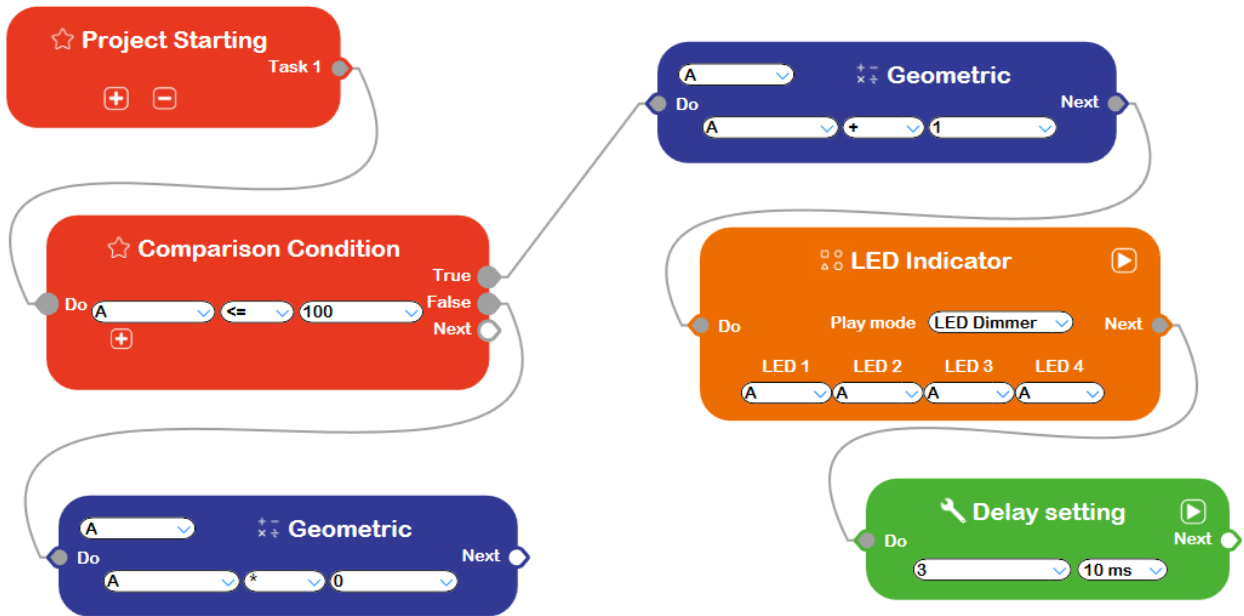
Teaching Program		Projector 1: LED Distance Sensor - Functional Components of Distance Sensor (3rd Lesson)				
Class Size		20 people	Teaching Time (number of sessions)	90 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	Apply the concept and the software blocks learned in the 1 st ~ 3rd lessons to control the LED light changes.				
	Teaching Objectives	1. Learn to use a distance sensor to control the LED. 2. Learn about the LED software block --- digital computing block. 3. Learn about the program command --- comparative condition. 4. Learn to use the distance sensor to adjust the LED lighting changes.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic concepts, functions and applications of P-IV-1 programming language. 5. Application principles of information technology H-III-2. 6. Basic functional operation of common system platform S-III-1. 7. Systematic digital data management method of D-III-3.				
	Teaching Preparation	1. Teaching video--distance sensor control LED. 2. Software block --- digital computing block. 3. Program command --- PPT (comparative conditions teaching). 4. LED lighting and several distance sensor modules for the trainees.				
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources	
	Let the trainees learn to use the distance sensor to control the LED light.		LED teaching video appreciation	5'	Teaching video	
	Learn about the new software block principles and the operation of digital computing block.		Software block - digital computing block	15'	PPT (software block introduction)	
	Learn to use [Comparative Condition] program command through the lecturer' s introduction and synchronous teaching.		Program command teaching	10'	PPT (program settings) and synchronous teaching device	
	Let the trainees apply the settings and program comands learned in class to adjust the gradual brightness cycle of LED light.		DIY experience	30'	Several instructors, LEDs, and distance sensor modules	
	Let the trainees learn to change the LED light mode within a distance from the settings learned in class.		DIY experience		Several instructors, LEDs, and distance sensor modules	
	Guidance essentials and precautions.		1. Assist the students to use the software block correctly. 2. Guide the students to set up the program commands.			

	References 1. Teaching video --- distance sensor control LED https://v.youku.com/v_show/id_XMzY2NTk2NTAyNA==.html?spm=a2hzp.8253869.0.0 2. PPT (program commands) --- Comparative Conditions
	Appendix

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Video Introduction	Play the distance sensor teaching video 3: Distance sensor control LED light 1. Set variable A to perform a gradual brightness cycle of LED light. 2. Set four comparative conditions and different light numbers according to different distances.	5	※Explain while playing to allow the students to understand better.
Software Introduction	1. Introduction to geometric computation: Geometric computation can be used to add, subtract, multiply, and divide variables. 2. We can use the "Comparative Condition" block to set the command actions with distances. Then compare the conditions on the left of red block base command of "Comparative Condition."	10	※Teaching slideshow P.64~P.65
Program Commands	1. The function of Comparative Condition is to select the variables for comparison, and then set the following conditions. For example, when the distance between the car and the obstacle is less than 10cm. If the condition is met, it will execute "Established" for the subsequent modules. If it is not met, it will execute "Non-established" for the subsequent modules. Then, after executing the Established or Non-established module, it will further execute other modules. 2. (1) Explain an example of project starts by connecting it to the distance sensor. (2) Set up an Established Module: When the distance is <10cm, the light number is a flashing light. Set up a Non-established Module: When the distance is >10cm, execute the next comparative condition. (3) Under an Established condition, if the distance is <10cm, execute a flashing loop (loop → light up all light numbers + delay setting 5 → turn off all light numbers + delay setting 5). (4) Under a Non-established condition, execute the Established action when the distance is ≥10cm. When the distance is >20cm, the light will move to the left and right. Under the Non-established conditions of ≥10cm and ≤20cm, all light numbers will light up but in different brightness. 3. Further connect another delay setting of 50 (10ms).	15	※Teaching slideshow P.66 ~P.70
DIY Experience	1. First demonstrate how to use the comparative condition to make an LED light to perform a gradual brightness cycle: First, introduce the digital computing block and set a variable A. A is a variable to be computed next. The initial value is 0. Then, press Save. For project starts, connect it with a comparative condition and set when the variable A is ≤100, perform the Established and Non-established action: Click on the geometric computing of mathematical computation on the blue block, select variable A and add an additional 1 action. Then, call out the LED indicator module, select the light number dimmer mode. After all have been selected with a variable, connect them to time setting. Let's set it as 3 (10ms). Next, compute A multiplied by 0 when it is Non-established. Continue to add 1 until 100 and then return to 0 to achieve a repeat brightness cycle (as shown in the diagram). Here, remember to select A for the variable; otherwise, it will not act! 2. Next, allow the students to actually operate it once.	30	※Preparation: computers, motherboard modules, and LED modules ※Guide the students while they are operating to see how well they are doing.
DIY Experience	1. First demonstrate how to design an LED light mode that will change with distances: Activate the distance sensor and connect it to delay setting 50	30	※Preparation: computers, and all

	(10ms) for comparison. To clarify the induction value, connect it to "Display Returned Message" and start to set the comparative condition where all variables are S_DISTANCE. When the sensor detects $\leq 15\text{cm}$, allow all four LED lights to light up in brightness 1. Pay attention to the block connection and connect two blocks at the same time to allow four light numbers to light up in brightness 1. Then, set up another comparison. Click on + to increase the comparative condition, set when the sensor detects $\leq 30\text{cm}$ and $> 15\text{cm}$. When it is Established, allow the light numbers 2 and 3 to light up. When it is Non-established, set up a next comparison. For $\leq 45\text{cm}$ and $> 30\text{cm}$, allow the light number to flash. Connect it with one lighted LED plus delay setting 3, and then connect it with one distinguished LED plus delay setting 3. When it is Non-established, set up the next comparison. Set the sensor to move the light number left and right when it detects $> 45\text{cm}$ and the speed in 100. Finally, check for any blocks that are not connected (as shown in the diagram). 2. Next, allow the students to actually operate it once.		components of BeeCar ※Guide the students while they are operating to see how well they are doing.
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Lesson 11 (The Advanced Bottle Game)

Teaching Program		Project 1: LED Distance Sensor --- Functional Component LED (The Advanced Bottle Game)			
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study Information Education
Teaching Research	Teaching Philosophy	1. Let the trainees know how to operate the LED panel and set the light numbers through the game. 2. Train the trainees think and apply logically. 3. Train the trainees in mathematics computation and digital logic.			
	Teaching Objectives	1. Understand what an LED light is. 2. Understand the LED light operation panel. 3. Know what an LED module is. 4. Let the trainees follow the rules of the game, train their logical thinking, learn to set their own light numbers, and actually operate them on the panel. 5. Develop the ability to create with others using the information technology. 6. Enhance the logical ability and design of the trainees through different multiples. 7. Train the trainees to link and apply mathematics and information education.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Functions and operation of programming tool P-III-1. 2. Basic applications of programming tool P-III-2. 3. Display method of digital data D-III-2. 4. N-1-02 can understand the meaning of addition, subtraction, and solve problems in life.			
	Teaching Preparation	1. Game teaching video. 2. PPT description. 3. LED modules.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Explore the principles of LED through the game.		Rule description	10'	PPT teaching
	Understand the LED module through demo teaching.		Video + demo	30'	Teaching video
	Train logical thinking ability and skillful module interface operation through actually playing the game.		Practice (playing game)	40'	1. Several LED modules 2. One referee and several scorers
	Guidance essentials and precautions.		1. Guide the trainees to operate the LED module correctly. 2. Staff members are required to pay attention if the game process complies with the rules of the game. 3. A referee and scorers are required to assist in scoring.		
	Reference https://v.youku.com/v_show/id_XMzY2NjAzMTM5Mg==.html?spm=a2h3j.8428770.3416059.1				
	Appendix				

Appendix I

The game rules of The Bottle Game

1. The players first place the sensor at a fixed distance around the venue (77 cm from the center).
2. In each round, the players set the attack multiples (1-4 times, one light is equal to double).
3. When starting to attack, the players place the energy column arbitrarily in the field and throw two attack dices in multiples. The number of points on the attack dice added with the numeral on the player' s displayed light number is the attack power.
4. All players need to light up the lights in each attack. If one party does not light up the lights, it is impossible to throw the attack dice. In each attack, each player has three chances of attack.
5. Each player has 96 points. In each round, the points are deducted according to the strength of the attack (you will also be deducted). The player will be eliminated when his/her points are deducted until negative number, and the last one on the field is the winner.
6. When the last deduction point is exactly zero, it is a total switch to become the winner in this game.

Lesson 12 (Push Ball Game)

Teaching Program		Project 2: Motor & Bluetooth - Push Ball Game				
Class Size		20 people	Teaching time (number of sessions)	80 min.	Field of study	Information Education
Teaching Research	Teaching Philosophy	1. Let the trainees know how to control the motor through Bluetooth in operating the game. 2. Train the trainees to feel the sense of distance and the ability to operate. 3. Train the coordination of the hands and brain, and strategic design ability of the trainees.				
	Teaching Objectives	1. Know what a motor is. 2. Understand how to control the car through Bluetooth. 3. Know what Bluetooth is. 4. Let the trainees train their body coordination according to the rules of the game. 5. Develop the ability to compete with others using the information technology.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Functions and operation of programming tool P-III-1. 2. Basic applications of programming tool P-III-2. 3. Basic functional operation of common system platform S-III-1. 4. Display method of digital data D-III-2. 5. Applications of cloud service T-III-9 or tools.				
	Teaching Preparation	1. Game teaching video. 2. PPT description. 3. Remote control car module.				
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources	
	Explore the principles of motor and Bluetooth through the game.		Rule description	10'	PPT teaching	
	Learn how to operate a remote control car module through Bluetooth in demo teaching.		Video + demo	30'	Teaching video	
	Train logical thinking ability and skillful module interface operation through actually playing the game.		Practice (playing the game)	40'	1. Several remote control car modules 2. One referee	
	Guidance essentials and precautions.		1. Guide the trainees to operate the remote control car module correctly and skillfully. 2. Staff members are required to pay attention if the game process complies with the rules of the game. 3. A referee is required to assist in scoring.			
	Reference https://v.youku.com/v_show/id_XMzY2MDMzNjY2OA==.html?spm=a2h3j.8428770.3416059.1					
	Appendix: Appendix I The game rules of Push Ball Game					
	1. The game has a time limit of 15 minutes.					

	2. The ball is placed in the center of the field. 3. Both players start from the goal. 4. Players who can push the ball into their own hole get 3 points. If the ball is pushed out of bounds, the opponent gets 1 point (if the referee decides it is a tie, both sides get 1 point at the same time). 5. If the ball is pushed out of the field, the referee will place the ball back in the center of the field and start the game again. 6. Players are not allowed to touch the competition vehicles, and the offender is deducted 3 points. 7. When the time is over, the opponent who gets the higher scores wins.
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Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Opening Match	Now let' s play the game first, known as [Ball Attack] and then explain the rules of the game: 1. The game has a time limit of 15 minutes. 2. The ball is placed in the center of the field. 3. Both players start from the hole exit. 4. Players who can push the ball into their own hole get 3 points. If the ball is pushed out of bounds, the opponent gets 1 point (if the referee decides it is a tie, both sides get 1 point at the same time). 5. If the ball is pushed out of the field, the referee will place the ball back in the center of the field and start the game again. 6. Players are not allowed to touch the competition vehicles, and the offender is deducted 3 points. 7. When the time is over, the opponent who gets the higher scores wins.	10	※Teaching slideshow P.73 ※Preparation: computers, all components of BeeCar, a toy ball, mobile phones, and a scoreboard
Video Introduction	Play a demo video to let the students understand the rules of the game better.	5	※Understand if the students really understand the rules of the game.
Demo Match	Let the students play the game once to ensure that they can really play it.	20	
Start the Game	Start the game officially to let the students participate in it enthusiastically.	40	※Understand each student' s situation and ensure that they play the game seriously.

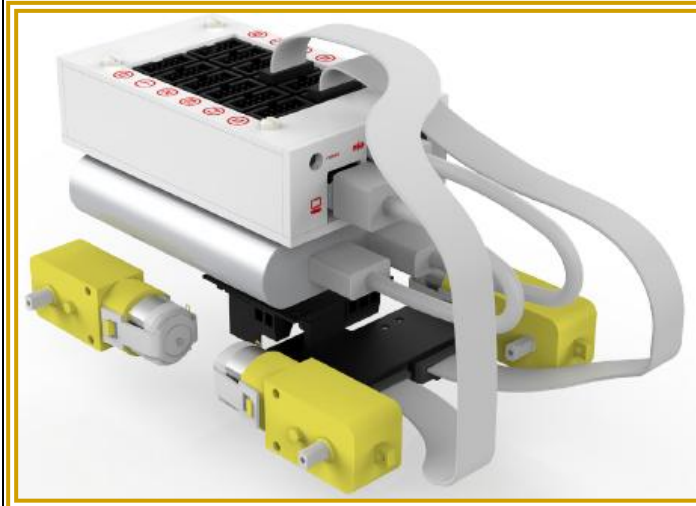
Lesson 13 (Motor 1)

Teaching Program		Projector 2: Motor Bluetooth - Functional Component Motor (1 st Lesson)			
Class size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study Information Education
Teaching Research	Teaching Philosophy	Let the trainees understand the principles and life applications of motor, know the relevant modules such as motor, and learn to move the car forward/reverse and speed through the software block.			
	Teaching Objectives	1. Understand the principles of motor. 2. Know the applications of motor in life. 3. Understand the motor module and connection method. 4. Understand the settings of the motor' s forward and reverse motions through the video. 5. Learn about the motor software block --- adjustment of positive and reverse rotation/speed/duration. 6. Learn to operate the car' s forward and reverse motions personally with a remote control.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Application principles of information technology H-III-2.			
	Teaching Preparation	1. PPT (motor introduction). 2. Demonstrate using the hardware device of the motor module. 3. Motor teaching video - forward and reverse motions. 4. PPT (motor software block introduction). 5. Several motor related modules for the trainees.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Let the trainees know the principles and applications of motor through PPT description.		Motor introduction	15'	PPT (LED introduction)
	Let the trainees know the motor related modules and connection through the actual hardware.		Hardware introduction	10'	Several motor related modules
	Learn how to let the car moves forward and reverse through the video.		Motor teaching video and description	5'	Motor teaching video
	Let the trainees learn to use the software block and apply it to adjust forward /reverse /speed /duration.		Software block introduction	20'	PPT (software block introduction)
	Let the trainees learn about the basic settings learned in class and apply it to adjust forward and reverse motions with the remote control car motor.		DIY experience	30'	Several instructors and LED modules
	Guidance essentials and precautions.				

References

1. Teaching video---forward and reverse motions
https://v.youku.com/v_show/id_XMzY2NTgyNTUwOA==.html?spm=a2hzp.8253869.0.0
2. Motor principles and PPT (applications)
3. [Hardware + PPT \(software\)](#) --- motor module and software block settings

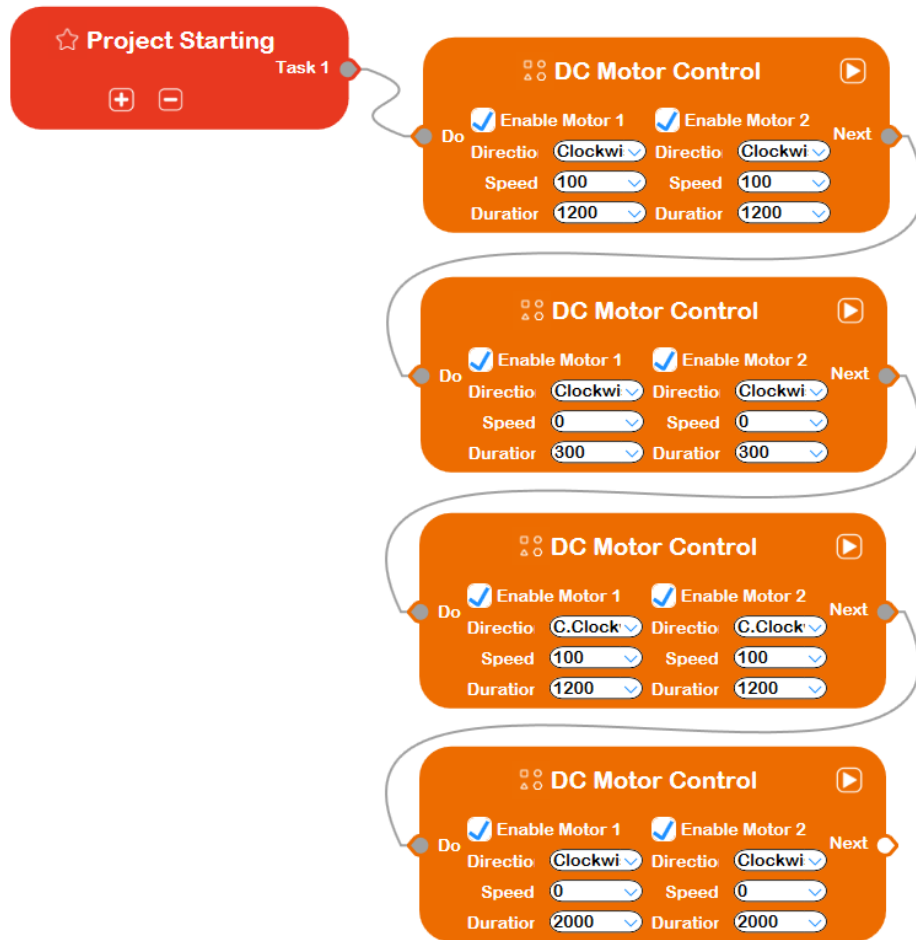
Appendix (finished module)



Teaching steps:

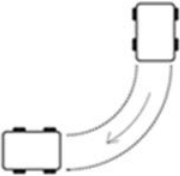
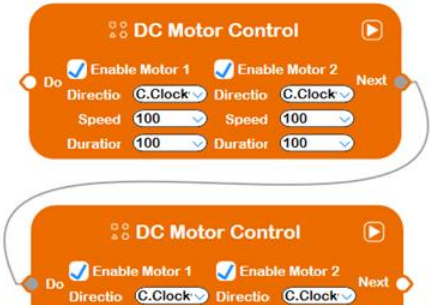
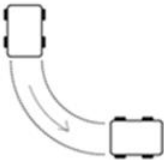
	Teaching Contents	Duration (min.)	Remarks
Knowledge Introduction	1. First introduce the motor: Following the current prevailing concept that electric vehicles are replacing the traditional vehicles, BeeCar uses an electric motor as the power to symbolize the future trend. Electric motors are relatively cheaper than conventional engines, and the transmission is faster, low noise, and more comfortable. Electric vehicles can enhance better and more comfortable driving experience. (Interaction: Ask the students what else have to rely on motor power to drive?) 2. The shape or nature changes of any object are related to energy, regardless of the ability to store, consume or converse. In our daily lives, energy is consumed while we are eating, exercising, driving, etc. There are many kinds of energy, the most common ones are: potential energy, kinetic energy, light energy, thermal energy, chemical energy, and electrical energy. 3. Motor converts electrical energy into kinetic energy. Before introducing energy conversion, first let's understand the right-hand rule – Conduct the wire with electricity and place it between two magnets. The wire will actually move! Scientists have discovered in many experiments that under certain circumstances, when a current-carrying wire is placed in a magnetic field, it will move as influenced by the magnetic force. 4. A simple DC motor uses the central magnetic field to steer. 5. How do you change the direction of the current? We can use a special electronic component known as "H Bridge" to change the circuit. When opening numbers 1 and 4 positions, and closing numbers 2 and 3 positions, the motor will rotate clockwise. When closing numbers 1 and 4 positions, and opening numbers 2 and 3 positions, the motor will rotate anticlockwise. When closing all positions, the motor will stop automatically. When closing numbers 1 and 3 positions, and opening numbers 2 and 4 positions, or inversely opening numbers 1 and 3 positions, and closing numbers 2 and 4 positions, the motor will stop.	15	※Teaching slideshow P.75~P.82
Module and Connection	1. Explain that the motor module should be inserted in No. 9 slot on the motherboard module, and it needs to be connected with a power supply. 2. The left half of the motor control panel controls the left front wheel and left rear wheel; and the right half of the motor control panel controls the right front wheel and right rear wheel. 3. Actually operating it once. 4. After finished assembling, show the schematic diagram to the students.	10	※Teaching slideshow P.83 ※Preparation: motherboard module, motor module, and battery ※After explaining, let the students operate it once.
Video Introduction	Play the motor module teaching video 1: Forward and reverse motions 1. Set forward motion → stop → reverse motion → stop 2. Add in LED lighting changes taught earlier.	5	※Explain while playing to allow the students understand better.
Software Introduction	1. First introduce the "Motor Control Module" by clicking on the orange block in the left control toolbar of the motor control module.	20	※Teaching video P.85~P.92

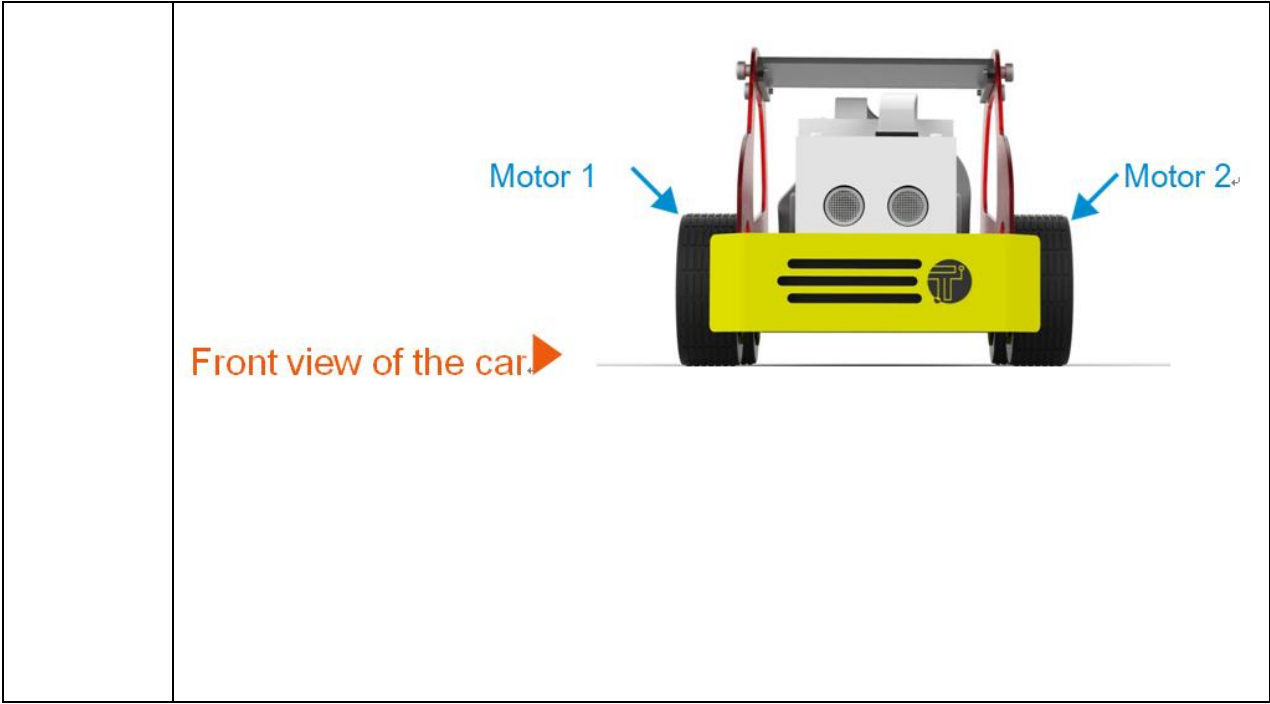
	2. Motor ON/OFF functions: Direction means optional forward and reverse rotation. Enter speed in numeric numbers (0~100) or select the variables using the pull-down menu (motor speed ratio is between 0~100). Enter the numeric numbers (0 ~∞) for duration (ms) or select the variables using the drop-down menu. 3. Looking from the front view of the car, on the left side is motor 1, and on the right side is motor 2. Tick either motor 1 or motor 2; otherwise, the program execution process will skip this module block. 4. <u>Straight forward motion</u>: Select positive rotation, a same speed and a same duration for both motors. In the software, set positive rotation for both motors. <u>Straight reverse motion</u>: Select reverse, a same speed and a same duration for both motors. In the software, set reverse rotation for both motors. <u>Turn right on the same spot</u>: Select motor 1 in reverse rotation and motor 2 in positive rotation, and similar speed and duration as in right turn conditions (the distance from the left wheel will be > right wheel). In the software, set motor 1 in reverse rotation, speed 90 and duration 1500 ms, and set motor 2 in positive rotation, speed 100 and duration 1500 ms. <u>Turn left on the same spot</u>: Set motor 1 in positive rotation and motor 2 in reverse rotation, and similar speed and duration as in right turn conditions (the distance from the right wheel will be > left wheel). In the software, set motor 1 in positive rotation and speed 100, motor 2 in reverse rotation and speed 90. Set both motors with a duration of 1500 ms. <u>Right differential turning</u>: Firstly, activate the left and right wheels simultaneously to move forward for a period of time. Then, set duration as 100 ms (0.1 seconds). Secondly, let the left wheel moves at a longer distance, and the right wheel a shorter distance. In the software, first set forward motion for 0.1 second. Then connect motor 1 and set it in positive rotation and speed 0, and motor 2 in positive rotation and speed 100. <u>Left differential turning</u>: Firstly, activate the left and right wheels and move forward for a period of time. At this time, set the time as 100 ms (0.1 seconds). Secondly, let the right wheel moves at a longer distance, and the left wheel a shorter distance. In the software, first set forward motion as 0.1 second, motor 1 to positive rotation and speed 100; and motor 2 to positive rotation and speed 0.		
Activity	1. First demonstrate [actual forward and reverse car test]. Project starts → first connect a forward-moving module, click on the motor control module, and tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration 1200 ms → then connect a stop motor module, tick both motors 1 and 2 and set them in positive rotation, speed 0 and duration 300 ms → then set a reverse-moving module, tick both motors 1 and 2 in reverse rotation, speed 100 and duration 1200 ms → finally, set a stop module, and tick both motors 1 and 2 and set them in speed 0 and duration 2000 ms. Remember to connect all modules. After entering into the motherboard, the car will move forward for 1.2 seconds, stop for 0.3 seconds, reverse for 1.2 seconds, and stop for 2 seconds (as shown in the diagram). 2. Next, let the students experience the activity personally.	30	Preparation: computers, and all components of BeeCar ※Guide the students while they are operating to see how well they are doing.



Lesson 14 (Motor 2)

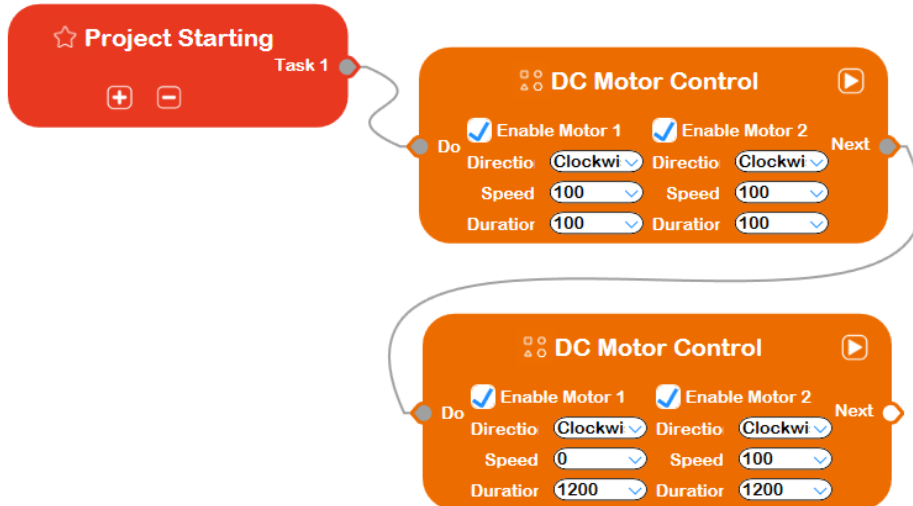
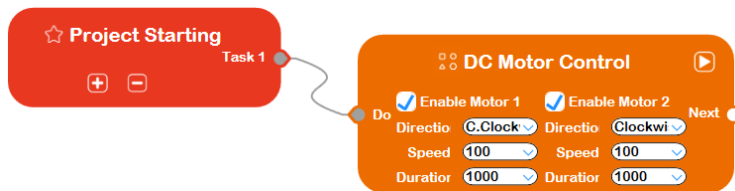
Teaching Program		Projector 2: Motor Bluetooth - Functional Component Motor (2nd Lesson)			
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study Information Education
Teaching Research	Teaching Philosophy	Let the trainees know the motor related modules, learn to operate the car’ s differential turning, and understand the reasons affecting the radius of gyration through the software block.			
	Teaching Objectives	1. Understand the settings of differential turning, and radius of gyration of motor through the video. 2. Learn the differential turning of car through using the remote control personally. 3. Explore and understand the reasons affecting the radius of gyration of the car.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Application principles of information technology H-III-2.			
	Teaching Preparation	1. Demonstrate the hardware device of the motor module. 2. Motor teaching video - differential turning and radius of gyration. 3. PPT (motor software block introduction). 4. Several motor related modules for the trainees.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Let the trainees know the principles and applications of motor through the video.		Introduction to differential turning and radius of gyration	10’	PPT (LED introduction)
	Let the trainees learn to use the software block and apply it to control car turning.		Software block introduction	10’	PPT (software block introduction)
	Let the trainees learn to turn the car through the activity.		DIY experience	30’	Several instructors and car motor modules
	Let the trainees apply the program grammers they just learned to the car and explore the reasons affecting the radius of gyration through the activity.		DIY experience	30’	Several instructors and car motor modules
	Guidance essentials and precautions.				
References 1. Teaching video --- differential turning and radius of gyration https://v.youku.com/v_show/id_XMzY2NTg0NjE4MA==.html?spm=a2hzp.8253869.0.0 2. PPT (program grammers) --- see Appendix I					

Left backward (Turning in differential speed). At the first step, the left and right wheels will start at the same time for a while, such as a period of time for 100 milliseconds is set (0.1 second). At the second step, the right wheel will travel backward a longer distance than left wheel.  Motor one (reverse, speed 100, duration 1500 ms).	Settings in software. 【Set the motors backward at 0.1 second, then set motor 1 with full speed at 100 and motor 2 with speed at 0】 
Right backward (Turning in differential speed). At the first step, the left and right wheels will start at the same time for a while, such as a period of time for 100 milliseconds is set (0.1 second). At the second step, the left wheel will travel backward a longer distance than right wheel.  Motor one (reverse, speed 0, duration 1500 ms). Motor two (reverse, speed 100, duration 1500 ms).	Settings in software. 【Set the motors backward at 0.1 second, then set motor 1 with speed at 0 and motor 2 with full speed at 100】 



Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Video Introduction	Play the motor teaching video 2: Differential turning and radius of gyration 1. Let' s compare the differences between turn left on the same spot and forward turn.	10	※Explain while playing to allow the students understand better.
Software Introduction	<u>Right differential speed turning</u> : Firstly, activate the left and right wheels simultaneously and reverse for a period of time. Then, set time in 100 ms (0.1 seconds). Secondly, let the left wheel moves at a longer distance, and the right wheel a shorter distance. In the software, first set reserve rotation for 0.1 second, and then connect motor 1 and set it in reverse rotation in speed 0, and motor 2 in reverse rotation and speed 100. Set both motors with a duration of 1500 ms. <u>Left differential speed turning</u> : Firstly, activate the left and right wheels simultaneously and reverse for a period of time at the same time. Then, set time in 100 ms (0.1 seconds). Secondly, let the right wheel moves at a longer distance, and the left wheel a shorter distance. In the software, first set reverse rotation for 0.1 second, and then connect motor 1 and set it in reverse rotation in speed 100, and motor 2 in reverse rotation in speed 0. Set both motors with duration of 1500 ms.	10	※Teaching slideshow P.95~P.96
Activity 1	1. [Actual car turning test] Firstly, let' s look at turn right on the same spot. First set a motor module, tick both motors 1 and 2 and set motor 1 in reverse rotation and motor 2 in positive rotation, both speed 100 and duration 1000 ms. After entering them into the motherboard, we can see that the car cannot turn satisfactory due to friction. "Friction" is the force that prevents the motion of an object between two contact surfaces. Next, let' s set a module that moves forward and then turns right, click on the motor control module, tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration 100 ms. Then, connect another motor module, tick motors 1 and 2 and set them in positive rotation, motor 1 in speed 0, motor 2 in speed 100, and duration in 1200 ms. We can see that the car turns very smoothly (as shown in the diagram). 2. Next, let the students experience the activity personally.	30	※Preparation: computers, and all components of BeeCar ※Guide the students while they are operating to see how well they are doing.
Activity 2	1. [Actual test to find out the cause affecting the radius of gyration of the car] Now let' s set two groups in forward motion and turn right but in different speeds. Let' s see the effect. First, connect one forward-movement module, tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration 100 ms. Then, tick another module and tick both motors 1 and 2 in positive rotation, but set motor 1 in speed 0, motor 2 in speed 100, and duration in 1200 ms. After entering them into the motherboard, we can see that the car has a small radius of gyration. Next, set a similar module as the previous one, but change motor 1 in speed 50, and motor 2 in speed 100. After entering them into the motherboard, we can see that the radius of gyration has become bigger. This shows that the greater the speed difference between two motors, the smaller the radius of gyration is; and the smaller the speed difference, the larger the radius of gyration is (as shown in the diagram). 2. Next, allow the students to experiment personally.	30	※Preparation: computers, and all components of BeeCar ※Guide the students while they are operating to see how well they are doing.



Lesson 15 (Push Ball Game)

Teaching Program		Project 2: Motor & Bluetooth - Advanced Push Ball Game				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	1. Let the trainees know how to control the motor through Bluetooth in operating the game. 2. Train the trainees to feel the sense of distance and the ability to operate. 3. Train the coordination of the hands and brain, and strategic design ability of the trainees.				
	Teaching Objectives	1. Learn how to control the car skillfully through Bluetooth. 2. Let the trainees train their body coordination according to the rules of the game. 3. Develop the ability to compete with others using the information technology.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Functions and operation of programming tool P-III-1. 2. Basic applications of programming tool P-III-2. 3. Basic functional operation of common system platform S-III-1. 4. Display method of digital data D-III-2. 5. Application of cloud service T-III-9 or tools.				
	Teaching Preparation	1. Game teaching video. 2. PPT description. 3. Remote control car module.				
Teaching Activity	Specific Objectives		Teaching Activity		Time	Teaching Resources
	Explore the principles of motor through Bluetooth in the game.		Rule description		10'	PPT teaching
	Learn how to operate a remote control car module through Bluetooth in demo teaching.		Video + demo		30'	Teaching video
	Train logical thinking ability and skillful module interface operation through actually playing the game.		Practice (playing the game)		40'	1. Several remote control car modules 2. One referee
	Guidance essentials and precautions.		1. Guide the students to operate the remote control car module correctly and skillfully. 2. Staff members are required to pay attention if the game process complies with the rules of the game. 3. A referee is required to assist in scoring.			
	Reference https://v.youku.com/v_show/id_XMzY2MDMzNjY2OA==.html?spm=a2h3j.8428770.3416059.1					
	Appendix: Appendix I The game rules of Push Ball Game					

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| | <ol style="list-style-type: none">1. The game has a time limit of 15 minutes.2. The ball is placed in the center of the field.3. Both players start from the hole exit.4. Players who can push the ball into their own hole get 3 points. If the ball is pushed out of bounds, the opponent gets 1 point (if the referee decides it is a tie, both sides get 1 point at the same time).5. If the ball is pushed out of the field, the referee will place the ball back in the center of the field and start the game again.6. Players are not allowed to touch the competition vehicles, and the offender is deducted 3 points.7. When the time is over, the opponent who gets the higher scores wins. |
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Lesson 16 (Bluetooth 1)

Teaching Program		Projector 2: Motor Bluetooth - Functional Components - Bluetooth (1 st Lesson)			
Class Size		20 people	Teaching time (number of sessions)	80 min.	Field of study Information Education
Teaching Research	Teaching Philosophy	Let the trainees understand the principles and life applications of Bluetooth, know the relevant modules such as Bluetooth, learn to operate the Bluetooth module through the software block, and use the program commands to read the block values.			
	Teaching Objectives	1. Understand the principles of Bluetooth. 2. Know the applications of Bluetooth in life. 3. Understand the Bluetooth module and connection method. 4. Understand how to use Bluetooth to receive characters transmitted by the mobile phone through the video. 5. Learn about the Bluetooth software block --- Bluetooth software module. 6. Learn to use the program command --- read the block values.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Application principles of information technology H-III-2.			
	Teaching Preparation	1. PPT (Bluetooth introduction). 2. Hardware device for demonstrating Bluetooth module. 3. Bluetooth teaching video --- receiving the characters transmitted by mobile phone. 4. PPT (Bluetooth software block introduction). 5. Several Bluetooth related modules for the trainees.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Let the trainees know the principles and applications of Bluetooth through PPT description.		Bluetooth introduction	15'	PPT (Bluetooth introduction)
	Let the trainees learn about the Bluetooth related modules and connection through the actual hardware.		Hardware introduction	5'	Several Bluetooth related modules
	Learn how to receive characters from the mobile phone through the video.		Bluetooth teaching video and description	10'	Bluetooth teaching video
	Let the trainees learn to use the software block and apply it to operate Bluetooth software module.		Software block introduction	10'	PPT (software block introduction)
	Learn to use [Read the Block Values] program command through the lecturer' s introduction and synchronous teaching.		Program command teaching	10'	PPT (program settings) and synchronous teaching device
	Let the trainees apply the settings and programing commands learned in class to adjust Bluetooth module to read		DIY experience	30	Several instructors and Bluetooth modules

Bluetooth characters.			
Guidance essentials and precautions.			
References			
1. Teaching video --- receiving the characters transmitted by mobile phone https://v.youku.com/v_show/id_XMzcyOTY2MjQ0NA==.html?spm=a2h3j.8428770.3416059.1			
2. Bluetooth principles and PPT (applications)			
3. Hardware + software block + PPT (program commands)			
Appendix (finished module)			
			
The schematic diagram of an assembled module			

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Knowledge Introduction	- Let' s start with a brief introduction to Bluetooth: In the world we live in, there is a lot of information not transmitted by route, but by wireless transmission technology. One of them is Bluetooth wireless transmission technology that is used at close range, such as a remote control to turn on and off the TV, a mobile phone connected to the car to play music through Bluetooth, wireless mouse, etc. Bluetooth is a very convenient invention. (Interaction: Ask the students what else in our life are controlled by wireless Bluetooth?) - Bluetooth is a wireless communication technology standard, originally designed to wirelessly exchange data in a short distance. It can connect multiple devices, synchronize actions, such as, if I want to send photos to several mobile phones today, I can link up Bluetooth and send the photos directly, up to the people' s photo albums without transmitting to the chat software, and the people can download the photos one by one. The emergence of wireless Bluetooth transmission has three important meanings for consumer electronics: Bluetooth wireless transmission is a global unified communication standard, one-to-multiple controls, and Bluetooth specifications.	15	※Teaching slideshow P.100~P.101
Module and Connection	- First introduce that the Bluetooth module should be inserted in No. 1 slot of the motherboard module. - Actually assemble it once. - Show the students how it is assembled.	5	※Teaching slideshow P.102 ※Preparation: motherboard modules, Bluetooth modules, and FC cables ※After explaining, allow the students to operate it once personally.
Video Introduction	Play the Bluetooth module teaching video 1: Receiving the characters transmitted by mobile phone.	10	※Explain while playing to allow the students understand better.
Software Introduction	Introduce the "Bluetooth Communication Module" at the orange block in the left toolbar of Bluetooth module block.	10	※Teaching slideshow P.104
Program Commands	- The mobile phone app can control the car to perform forward, reverse, left, right, and stop functions. - How do read the block values? Project starts → Bluetooth module → connect a Display Returned Message block, and select the S_BLUETOOTH variable. - Click on the upper magnifying glass button "Display Returned Message" to display the received message.	10	※Teaching slideshow P.105~P.106
DIY Experience	First demonstrate to read Bluetooth characters: Click on the Bluetooth communication module at the left toolbar and connect to project starts, then click the Display Returned Message block, select S_BLUETOOTH to receive the Bluetooth characters. Next, use the mobile phone to download BluetoothSPP. Install the blue SPP into the program and	30	※Preparation: computers, motherboard modules, Bluetooth modules, and mobile phones

	operate by following the steps shown on the screen. Turn on the mobile phone' s Bluetooth function, and first set three buttons A, S, and D. After setting, return to the software interface, and enter the project into the motherboard. Click on the Play button to execute. At this time, if the Bluetooth module is not connected, a small red light will flash constantly. Connect the Bluetooth module through BluetoothSPP, select the corresponding serial number of the Bluetooth module. After connecting to Bluetooth, the red light will stop flashing. At this time, open the Display Returned Message and press the mobile phone to receive the corresponding characters. 2. Next, let the students experience to read the Bluetooth characters personally.		※Guide the students while they are operating to see how well they are doing.
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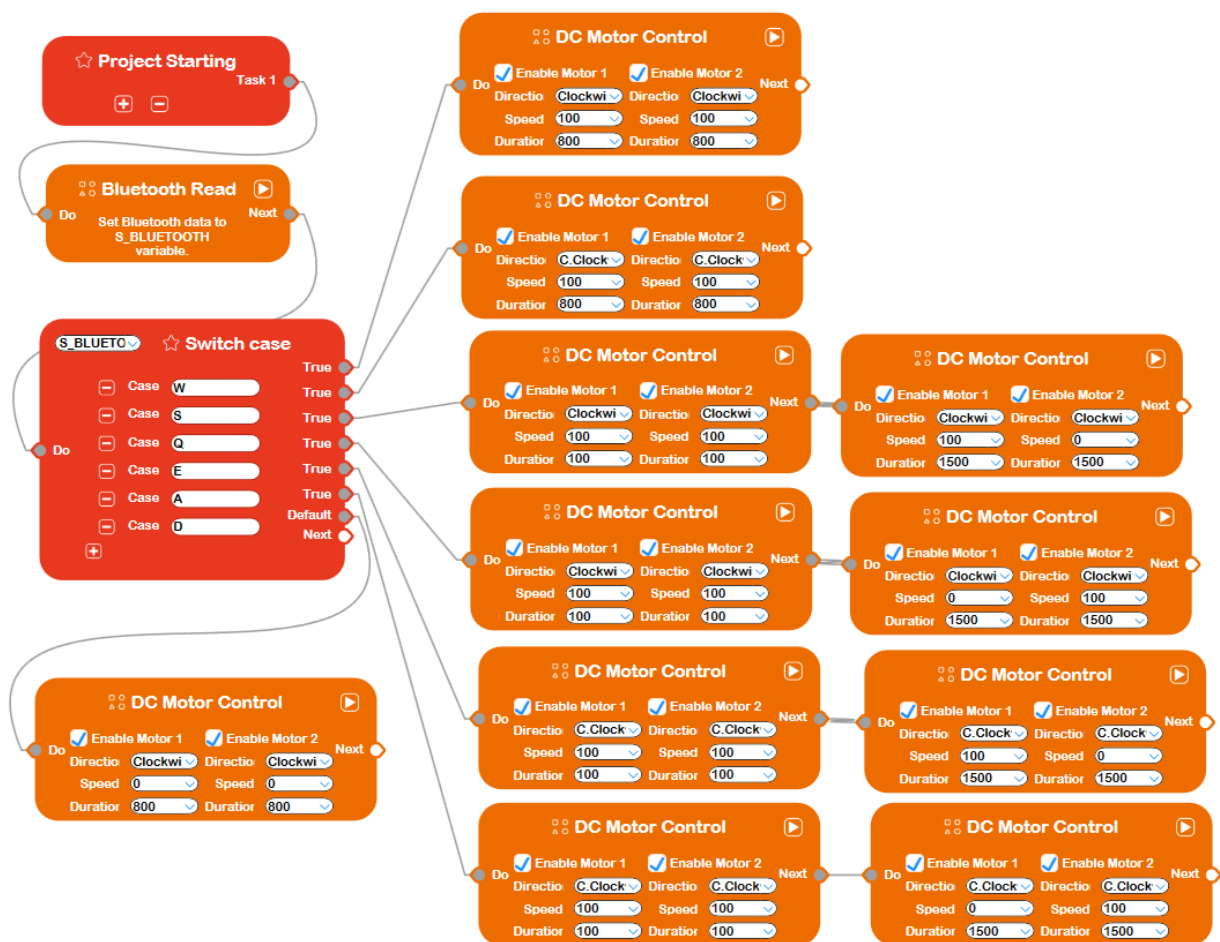
Lesson 17 (Bluetooth 2)

Teaching Program		Projector 2: Motor Bluetooth - Functional Components - Bluetooth (2 nd Lesson)			
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study Information Education
Teaching Research	Teaching Philosophy	Let the trainees learn about the relevant modules such as Bluetooth, and learn to operate the Bluetooth characters to control the motor through the software block.			
	Teaching Objectives	1. Understand how Bluetooth characters are used to control the motor through the video. 2. Learn about the software blocks of variables and field types (character type). 3. Learn about the program command - conditional description command. 4. Learn to control the car and adjust its turning personally through the Bluetooth module.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Application principles of information technology H-III-2.			
	Teaching Preparation	1. PPT (Bluetooth introduction). 2. Bluetooth teaching video --- receiving the characters transmitted by mobile phone 3. PPT (Bluetooth software block introduction). 4. Several Bluetooth related modules for the trainees.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Let the trainees know how to control the car motor through the Bluetooth module in video.		Introduction to Bluetooth character - controlled motor	10'	PPT (Bluetooth introduction)
	Let the trainees learn to use the software block --- variables and field types description (character type), and apply it to control the Bluetooth module.		Software block introduction	15'	PPT (software block introduction)
	Learn to use the [Conditional Description] program command through the lecturer' s introduction and synchronous teaching.		Program command teaching	15'	PPT (program command teaching)
	Let the trainees apply the program grammars they just learned to the car, and learn to control the car and adjust its turning through the activity.		DIY experience	40'	Several instructors and Bluetooth car motor modules
	Guidance essentials and precautions.				
	References 1. Teaching video - Bluetooth character-controlled motor https://v.youku.com/v_show/id_XMzcyOTY2MjEzMg==.html?spm=a2h3j.8428770.3416059.1 2. Software + PPT (program grammars)				

Teaching steps:

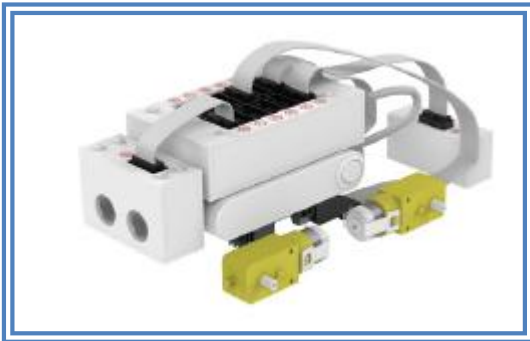
	Teaching Contents	Duration (min.)	Remarks
Video Introduction	Play Bluetooth module teaching video 2: Bluetooth character control motor	10	※Explain while playing to allow the students to understand better.
Software Introduction	Introduce that the integer types in the variable setting are 1~100, and the characters are A~Z.	15	※Teaching slideshow P.109
Program Commands	- Next, introduce the "Conditional Description" of our program: After knowing the characters corresponded by the app functions, you can write the actions corresponding to the buttons using the Conditional Description Module. You can then add in conditions and write the corresponding actions. - Select the variable S_BLUETOOTH and establish the actions that meet the conditions. When executing other non-compliance action conditions, you have to complete the following steps of conditional judgment, corresponding actions, execution... - Let's take an example: Based on the returned message, we can determine the buttons and corresponding characters as shown in the following table. At this point, we must use uppercase and lowercase English letters. W (forward), S (reverse), Q (left front), E (right front), A (left rear), and D (right rear). - The software program ordering is: project starts → Bluetooth communication module → conditional description	15	※Teaching slideshow P.110~P.113
DIY Experience	First demonstrate to [control the car and adjust its turning]: Now let's set up a BeeCar control through Bluetooth with the mobile phone. Click on Bluetooth and connect to Conditional Description, press + to add in conditions, and there are a total of 6 additions. Select S_BLUETOOTH. List the following corresponding characters in order in the frame: W (forward), S (backward), Q (left front), E (right front), A (left rear), and D (right rear). Connect W to the motor control module, tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration 800 ms. Connect S to the motor control module, tick both motors 1 and 2 and set them in reverse rotation, speed 100 and duration 800 ms. Connect Q to the motor control module, tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration 100 ms. Connect a turn-left motor module and tick both motors 1 and 2 and set them in positive rotation, motor 1 in speed 100, motor 2 in speed 0, and duration in 1500 ms. Connect E to the motor control module, tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration 100 ms. Connect the right-turn motor module, tick both motors 1 and 2 and set them in positive rotation, motor 1 in speed 0, motor 2 in speed 100, and duration in 1500 ms. Connect A to the motor control module, tick both motors 1 and 2 and set them in reverse rotation, speed 100 and duration 100 ms. Connect a left rear turn-motor module, tick both motors 1 and 2 and set them in reverse rotation, motor 1 in speed 100, motor 2 in speed 0, and duration in 1500 ms. Connect D to the motor control module, tick both motors 1 and 2 in reverse rotation, speed 100 and duration 100 ms.	40	※Preparation: computers, and all components of BeeCar ※Guide the students while they are operating to see how well they are doing.

	Connect a right-rear-turn motor, tick both motor 1 and 2 in reverse rotation, motor 1 in speed 0, motor 2 in speed 100, and duration in 1500 ms. For the following executions, set the car in a static state if the Bluetooth does not receive the characters, tick both motors 1 and 2 of the motor control module and set them in positive rotation, speed 0 and duration 800 ms) Finally check if there are modules that have not been connected, enter them into the motherboard, then turn on the mobile phone and link up with Bluetooth. Next, set the mobile phone buttons, W (forward), and so forth.		
	2. Next, allow the students to do it personally.		



Lesson 18 (Automatic braking)

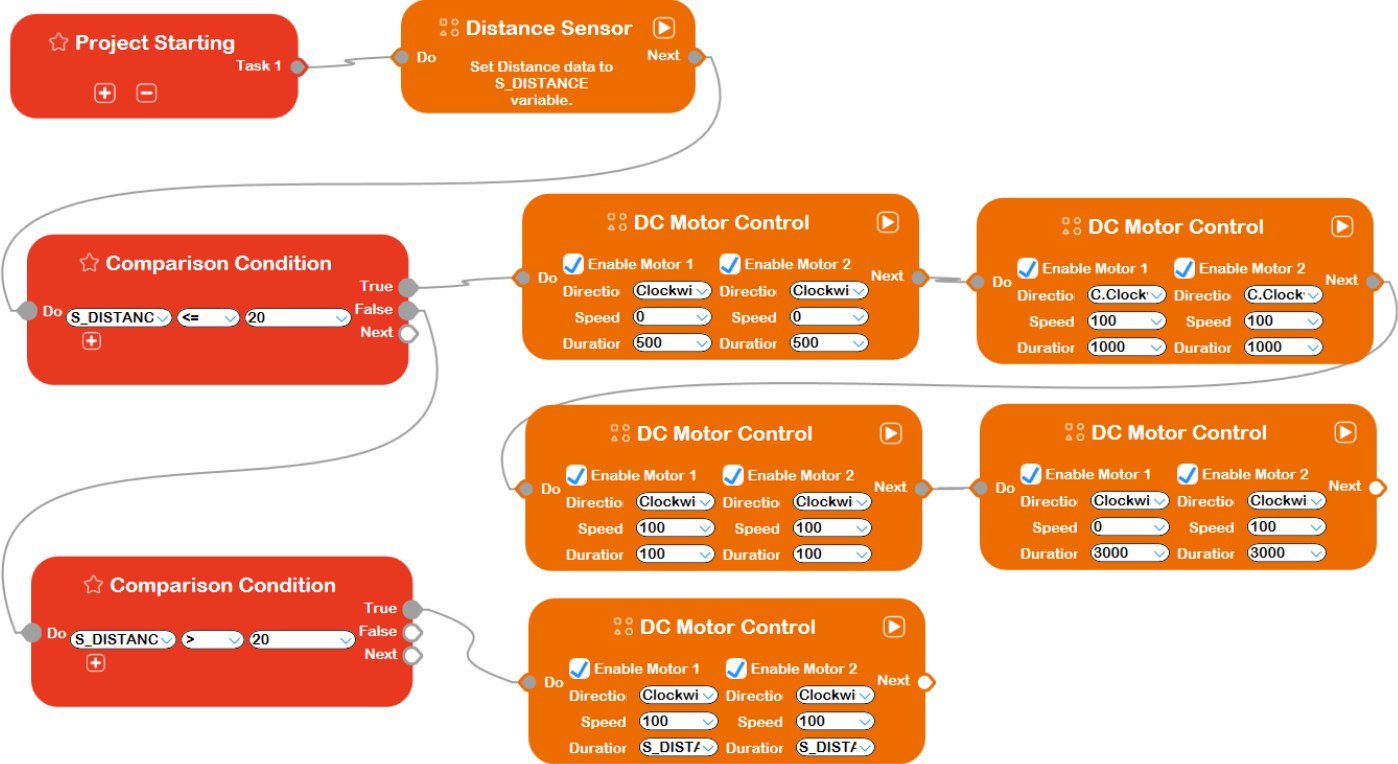
Teaching Program		Projector 3: LED Distance Sensor Motor Bluetooth - Self-propelled Car Applications: Auto Stop			
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study Information Education
Teaching Research	Teaching Philosophy	Let the trainees understand the principles and life applications of auto stop; review and comprehensively arrange and assemble the motor, distance sensor, Bluetooth, LED, and other related modules; and learn to operate auto stop and car turns through the remote control car using the software block.			
	Teaching Objectives	1. Understand the principles of auto stop. 2. Learn about the applications of auto stop system in life. 3. Understand the assembly and connection among the motor, distance sensor, Bluetooth, and LED module. 4. Learn about the applications of auto stop through the video. 5. Learn to use program commands - add all directions of the motor, such as auto stop/reverse/turn into the library.			
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Application principles of information technologyH-III-2.			
	Teaching Preparation	1. PPT (auto stop introduction). 2. Demonstrate to use motor, distance sensor, Bluetooth, and LED module hardware device. 3. Auto stop teaching video --- applications of auto stop system. 4. Several motors, distance sensors, Bluetooth, and LED related modules for trainees.			
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources
	Let the trainees know the principles and applications of auto stop through PPT description.		Auto stop introduction	5'	PPT (auto stop introduction)
	Let the trainees learn about the motor, distance sensor, Bluetooth, LED related modules, etc, and assemble them through the actual hardware.		Hardware introduction	5'	Several motors, distance sensors, Bluetooth, and LED related modules
	Understand the applications of auto stop system through the video.		Auto stop system teaching video and description	10'	Auto stop system teaching video
	Learn to use [add all directions of the motor such as auto stop/reverse/turn into the library) program commands through the lecturer' s introduction and synchronous teaching.		Program command teaching	20'	PPT (program commands) and synchronous teaching device
	Let the trainees design the car controls that automatically stops or turns away when encountered the obstacles from the settings		DIY experience	40'	Several instructors, motors, distance sensors, Bluetooth, and LED

and program commands learned in class.			modules.
Guidance essentials and precautions.			
References			
1. Teaching video --- applications in life: auto stop system https://v.youku.com/v_show/id_XMzY5OTIyNTY1Ng==.html?spm=a2h3j.8428770.3416059.1 2. Auto stop system applications + hardware + PPT (program commands)			
Appendix (finished module)			
		The schematic picture of an assembled BeeCar	
			

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Knowledge Introduction	1. First introduce the principles of autonomous car: In car collision avoidance system, the active car distance control uses “ultrasonic sensor” to judge the distance, and further control the brake and throttle to maintain a distance from the front vehicle, reduce the speed and avoid the risk of hitting the front vehicle at a high speed. For night driving, the car assistance system uses an “infrared night vision lens” to detect the heat sources, such as pedestrians or animals, thereby avoiding accidents on the road. 2. FCM intelligent brake assist system will automatically detect the distance from the front vehicle. When there is danger of collision, it will emit a warning tone and provide assistance for braking. It can play the role of early warning and can also automatically brake at the critical moment of high collision risk, thus avoiding an accident when the driver cannot react on time.	5	※Teaching slideshow P.116~P.117
Module and Connection	1. Insert the modules introduced in the previous section into the corresponding positions (No. 0 for sensor, No. 5 for LED module, No. 9 for motor module, and power supply for motor power supply). 2. Actually operate it once. 3. Show the students how the assembled unit looks like.	5	※Teaching slideshow P.118 ※Preparation: all components of BeeCar ※After explaining, allow the students to operate once personally.
Video Introduction	Play teaching video 1: Auto stop applications	10	※Explain while playing to allow the students understand better.
Activity	1. Demonstrate to make an auto stop or auto turning action when the car encounters an obstacle. Now let's set up a program that when the car meets an obstacle, it will stop automatically, reverse and turn. First, click on the distance sensor and the built-in variable in S_DISTANCE system, and connect it with the comparative condition. When the distance is ≤ 20 cm, set up an Established Module. Click on the motor control module to let the motor stop first, tick motors 1 and 2, and set the speed 0 and duration 500 ms. Then, set a reverse action → click on motor control module and connect it with the previous stop direction. Tick to activate both motors 1 and 2 in reverse rotation, speed 100 and duration 100 ms. Then set up a turn-right car action, as it is a forward right turn, it needs to first set a forward module. Tick both motors 1 and 2 in positive rotation, and set speed 100 and duration 100 ms. Then connect a turn-right module, click on the motor control module, tick both motors 1 and 2 and set them in positive rotation, motor 1 in speed 0, motor 2 in speed 100, and duration in 3000 ms. As the turning time is affected by frictional force and as the friction coefficient at this point is relatively high, so set the duration longer. The above settings will allow the car to stop, reverse and turn right when encountered with an obstacle. Next, set up a module when the comparative condition is Non-established. Set that when the	40	※Preparation: computers, and all components of BeeCar ※Guide the students while they are operating to see how well they are doing.

	sensing distance is > 20 cm, the car will continue to move forward. Click on the Comparative Condition and connect it to the previous Comparative Condition that is Non-established. When the distance is > 20 cm, click on the motor control module, tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration S_DISTANCE. To keep the car moving forward, set the duration in distance variable. 2. Next, allow the students to operate it.		
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Lesson 19 (Automatic follow-up)

Teaching Program		Project 3: LED Distance Sensor Motor Bluetooth - Self-propelled Car Applications: Auto Tailgate				
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education
Teaching Research	Teaching Philosophy	Let the trainees understand the principles of auto fixed distance/tailgate and life applications; learn to operate the tailgate system of the remote control car to detect the front distance and maintain a fixed distance through the program commands.				
	Teaching Objectives	1. Understand the principles of auto tailgate system. 2. Learn about the applications of auto tailgate system in life. 3. Understand auto fixed distance/tailgate applications through the video. 4. Learn to use the program commands - add all directions of the motor into the library of auto tailgate system.				
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Application principles of information technology H-III-2.				
	Teaching Preparation	1. PPT (auto tailgate introduction). 2. Auto tailgate teaching video - auto fixed distance/tailgate applications. 3. Several motors, distance sensors, Bluetooth, and LED related modules for the trainees.				
Teaching Activity	Specific Objectives		Teaching Activity		Time	Teaching Resources
	Let the trainees know the principles and applications of auto tailgate through PPT description.		Auto tailgate introduction		5'	PPT (auto tailgate introduction)
	Understand auto fixed distance/tailgate applications through the video.		Auto fixed distance/tailgate application teaching video and description		10'	Auto fixed distance/tailgate teaching video
	Learn [add all directions of motor into the library of auto tailgate] command through the lecturer' s introduction and synchronous teaching,		Program command teaching		25'	PPT (program commands) and synchronous teaching device
	Let the trainees learn about the settings and program commands learned in class to detect the distance from the front vehicle and keep at a fixed distance.		DIY experience		40'	Several instructors, motors, distance sensors, Bluetooth, and LED modules
	Guidance essentials and precautions.					
	References					
1. Teaching video --- auto fixed distance/tailgate applications https://v.youku.com/v_show/id_XMzY5OTIyNTg3Ng==.html?spm=a2h3j.8428770.3416059.1 2. Introduction to auto tailgate system (see appendix)						

Appendix

► Auto vehicle tailgate control



When there is risk of collision, it will give out warning alarm.



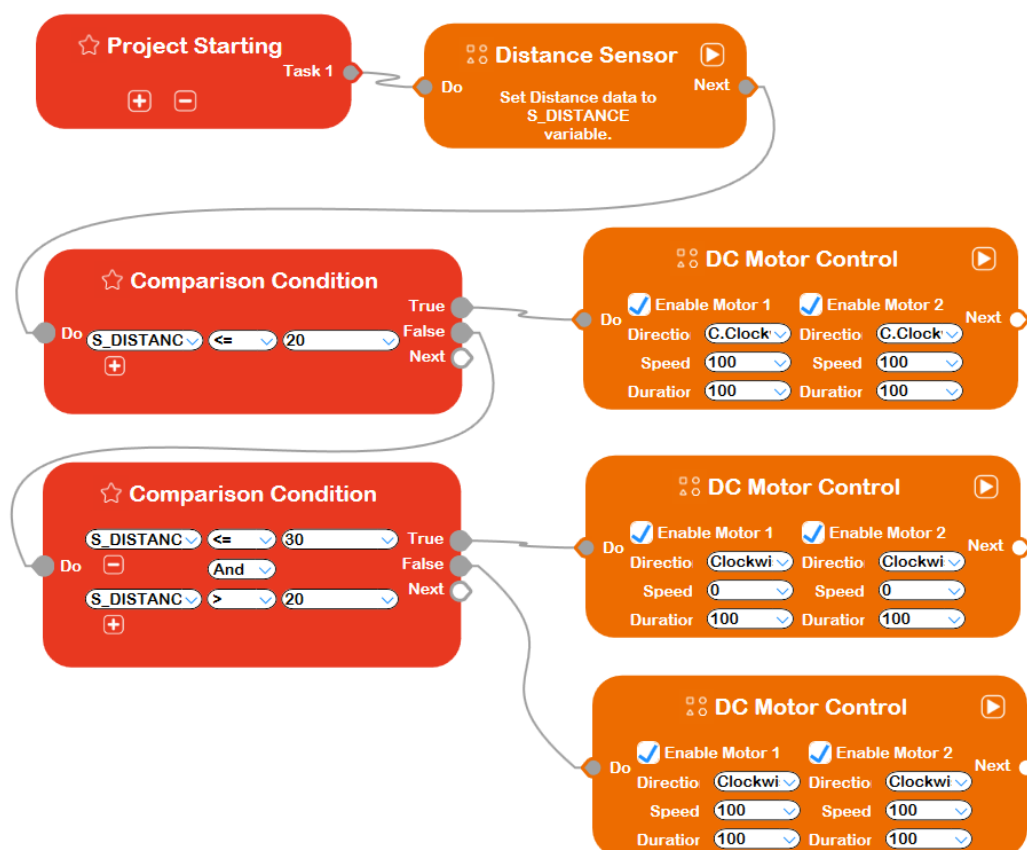
When there is high collision risk, it will provide braking assistance.



Continue to move forward with no car ahead.

Teaching steps:

	Teaching Contents	Duration (min.)	Remarks
Knowledge Introduction	Auto tailgate control: The Adaptive Cruise Control (ACC) system will detect the speed of the front vehicle during cruising, dynamically adjust the cruising speed, and keep at an appropriate cruising distance.	5	※Teaching slideshow P.121
Video Introduction	Play teaching video 2: Auto fixed distance/tailgate applications	10	※Explain while playing to allow the students understand better.
Activity	- First demonstrate to [design a tailgate system to detect the distance in front and keep at a specific distance]. First click on the distance sensor and the built-in variable in S_DISTANCE system, connect them to the Comparative Condition. Set when the distance is ≤ 20 cm, execute reverse action (in the motor control module, tick both motors 1 and 2 and set them in reverse rotation, speed 100 and duration 100 ms. Next, make a comparison if it is Non-established at ≥ 30 cm and > 20 cm. When it is Established, execute a stop action (in the motor control module, tick both motors 1 and 2, and set speed 0 and duration 100 ms). Set forward action if it is Non-established (tick both motors 1 and 2 and set them in positive rotation, speed 100 and duration 100 ms). - It will act like a modern car. When there is no vehicle in front, the car will continue to move forward. When there is a vehicle in front, the distance sensor will detect the relative distance and automatically stop moving forward. - Next, allow the students to experience the activity.	40	※Preparation: computers, and all components of BeeCar ※Guide the students while they are operating to see how well they are doing.



Lesson 20 (Final Activity)

Teaching Program		Projector 3: LED Distance Sensor Motor Bluetooth - Results Announcement					
Class Size		20 people	Teaching Time (number of sessions)	80 min.	Field of Study	Information Education	
Teaching Research	Teaching Philosophy	1. Let the trainees set their goals and perform actual operation through the hardware assembly skills they learned in the previous lessons. 2. Review and comprehensively assemble the motor, distance sensor, Bluetooth, LED, and other related modules. 3. Learn to assemble a car model using personal program commands and software blocks through group discussion and cooperation, and divide the work to present the characteristics of operating the remote control car and its application principles.					
	Teaching Objectives	1. Review the principles and applications of LED and distance sensor learned in class. 2. Review the principles and applications of motor Bluetooth learned in class. 3. Review to apply the program commands and software blocks learned in class. 4. Learn to set a desired goal and actually operate the test work. 5. Learn team cooperation to assemble an individual work into a group creation.					
	Teaching Program Corresponding to Segmentation Capability Index	1. Brief introduction to the procedural problem solving method of A-III-1. 2. Functions and operation of programming tool P-III-1. 3. Basic applications of programming tool P-III-2. 4. Basic functional operation of common system platform S-III-1. 5. Application principles of information technology H-III-2.					
	Teaching Preparation	1. Group work + PPT (target description). 2. Several motors, distance sensors, Bluetooth, and LED related modules for the trainees.					
Teaching Activity	Specific Objectives		Teaching Activity	Time	Teaching Resources		
	Explain group work and goals, and let the trainees present their goals through what they have learned.		Division of work and target description	10'	PPT (division of work description)		
	Let the trainees actually operate the module and test the results and apply the assembly skills they learned to their modules through their own settings.		Setting and practicing	15'	Several motors, distance sensors, Bluetooth, and LED related modules		
	Assemble the software blocks with the program commands learned in class through group discussion and cooperation.		Group discussion and assembling	15'	Several technical instructors		
	Discuss the applications and features of other works through group discussion.		Results announcement	40'	Several technical instructors		
	Guidance essentials and precautions.						
	Reference						

The schematic picture of an assembled BeeCar

