

Experiment Manual Introduction to

AI at Your Fingertips

1. Experiment Manual Overview

The age of artificial intelligence (AI) has arrived. There are applications of AI technologies in our lives and work, which can be called “AI at your fingertips”. Governments of various countries have also begun to attach importance to AI, and many developed countries have raised AI to the height of national strategies, and believe that the degree of mastery and application of AI technologies is closely related to the future international status of a country. The tide of AI has swept across in our country and there is a great demand for professional talents, but school education in AI is not ready and talent reserves are not prepared for it. In addition to training professional talents, the education sector needs to shoulder the responsibility of popularizing AI. The schools should allow most students to be prepared for using AI in the future and coexisting with AI.

However, AI education is a brand-new field. The subject definition, teaching content, and teaching methods for AI education are very different from those for traditional

subject education. Therefore, a series of topics have been put forwarded for educators, such as how to strengthen the research on the nature of AI, refine the appropriate teaching content in each teaching period, and explore AI teaching methods. In recent years, a large number of AI textbooks have been available, but these textbooks have various problems. Some textbooks are far from meeting the curriculum standards, and other textbooks lack AI solutions and AI carriers, making it difficult for teachers to use them in schools.

The *AI at Your Fingertips* experiment manual provides AI learning solutions for students from grade three of primary schools to grade 2 of senior middle schools. The experiments are based on real-world scenarios and focuses on basic issues. In the process of exploring, students complete project-based operations so as to understand, master, and skillfully use the knowledge and technologies of AI. The experiments start with scenes familiar to students in daily life, and provide problems that need to be solved. The purpose is to let students master the corresponding knowledge and skills and develop thinking by clarifying, analyzing, solving problems and completing expanded tasks in project practice.

This experiment manual consists of eight volumes, each of which is based on a topic, and each topic contains several activities. The subjects are expanded around image recognition, face recognition, text recognition, and speech recognition. By completing the tasks of the experiment manual, enable students to gradually form an overall understanding of the concept of AI, understand AI technologies, and use AI technologies to solve problems in life, so as to develop their information awareness, digital learning and innovation, information society responsibilities, computational

thinking.

(I) Main Content

The content of the experiment manual is mainly divided into six modules: experiment overview, experimental purpose, experiment equipment, experiment requirements, experiment tasks, and learning evaluation. Different experimental subjects correspond to different quantities of experimental tasks, and each task corresponds to one or two class sessions.

(II) Design Principles

The experiment manual is designed based on the following three principles:

- Teaching AI to promote social development. The core of our courses is to teach AI to have a positive impact on society and train students to use technologies to create a more suitable living environment. However, some heavy content will be involved, so that when using technologies, students must also recognize the moral issues and other society impacts that AI technologies inevitably pose.
- Using fun as the design core of the experimental content. The teaching emphasizes the fun of the content, creates a real and natural teaching environment according to the characteristics of the students' interests, and integrates real scenarios into the cases of the classes.
- Conducting project-based learning by using problem exploring. Students explore problems and collaborate with teammates to complete tasks. Therefore, the students can also gain soft skills such as problem solving,

leadership, and writing.

2. Experiment Manual Outline

There are three experiment manuals: *AI Campus*, *AI Mall* and *AI Farm*. 24 class sessions are recommended for each manual.

Programming software: Scratch, Arduino

Hardware recommendation: Sensor kit, Magician Lite robot arm, MOOZ-2 Plus

1. AI Campus

This experiment topic is a total of 24 class sessions. By simulating the smart campus scenario, enable students to perceive and experience the application of image recognition technology, speech recognition technology, OCR text recognition technology, and facial recognition technology in the AI field in daily life.

Experiment Subject	Experiment Task	Objectives	Sessions	Remarks
Repeated Stamping	General task: stamping robot Task 1: Single stamping Task 2: Multiple stamping Task 3: Infinite stamping	1. Understand the sequence structure and master the instructions to control the robotic arm. 2. Understand the finite loop and master the limited loop instructions and the application scenarios. 3. Understand infinite loops and master infinite loop instructions and application	3	

		scenarios.		
Campus Porter	<p>General task: Robot Porter</p> <p>Task 1: Do the Same Action Repeatedly</p> <p>Task 2: Applying the Formula</p> <p>Task 3: Transporting Two Objects</p> <p>Task 4: Transporting Four Objects</p>	<ol style="list-style-type: none"> 1. Be familiar with the creation and use of variables in DobotScratch and build variable applications. 2. Be able to deduce the formula for change of the book stack height and apply it to motion instructions. 3. Understand the loop structure and use the loop programming approach in the programming process. 4. Understand repeated execution with judgment conditions, and master the instructions of repeated execution and the application scenarios. 	4	
Garbage Classification	<p>General task: Task 1: Garbage Collection and Training</p> <p>Task 2: Image Identification</p> <p>Task 3: Voice Prompts</p>	<ol style="list-style-type: none"> 1. Learn the knowledge of garbage classification. 2. Master image recognition instructions. 3. Be skilled in using speech recognition instructions. 4. Master logic operation instructions. 5. Program to implement automatic garbage sorting by the robotic arm. 	3	

Desk Tidying	<p>General task: Task 1: Training Model Task 2: Recognize and Segment the Image Task 3: Complete Desk Arrangement Task 4: Use the Multi-branch Structure</p>	<ol style="list-style-type: none"> 1. Grasp the method for training the image classification model in DobotScratch. 2. Grasp image segmentation and recognition instructions and create image segmentation and recognition programs. 3. Grasp the steps of establishing variables and understand the difference between global variables and local variables. 4. Understand the multi-branch selection structure of the program and create a stationery classification program. 5. Understand fixed-point grabbing and automatic grabbing. 6. Experience the application of image segmentation and recognition technologies, and create a desk finishing program. 	4	
Smart Cafeteria	<p>General task: Voice reception robot Task 1: Invoke The Speech Recognition Instruction Task 2: Facial Data Collection and Training Task 3: Order by</p>	<ol style="list-style-type: none"> 1. Understand speech recognition technology and facial recognition technology. 2. Grasp logic operation instructions. 3. Grasp speech recognition instructions. 4. Grasp facial recognition instructions. 5. Program the "Cafeteria 	4	

	Voice Task 4: Face Payment	Assistant" system.		
Smart Library	General task: Text recognition robot Task 1: Making a Face Recognition System Task 2: Establish Voice-based Book Borrowing System Task 3: Establish OCR Book Returning System Task 4: Establish Complete Smart Library System	1. Experience the application of facial recognition technology. 2. Master the use of the facial recognition module in DobotScratch. 3. Experience the application of speech recognition technology. 4. Master the use of the speech recognition module in DobotScratch. 5. Experience the application of OCR text recognition technology. 6. Master the use of the text recognition module in DobotScratch. 7. Establish a complete smart library system.	6	

3. AI Mall

This experiment topic is a total of 24 class sessions. By simulating the AI application scenarios in a shopping mall, comprehensively use image recognition technology, speech recognition technology, OCR text recognition technology, facial recognition technology, etc. in the AI field, to cultivate students' computational thinking and practical abilities.

Experiment Subject	Experiment Task	Objectives	Sessions	Remarks
Identity Authentication	<p>General task: Establish a facial recognition attendance system</p> <p>Task 1: Create A Face Database</p> <p>Task 2: Design A Face Recognition-based Attendance System</p>	<ol style="list-style-type: none"> 1. Understand facial recognition technology. 2. Grasp the step of establishing a face database. 3. Learn the timer and implement the timing function. 	2	
Member identification	<p>General task: Master the method for communication between roles.</p> <p>Task 1: Create the Member Login System Interface</p> <p>Task 2: Complete the Face Recognition Program</p> <p>Task 3: Program the Member Login System</p>	<ol style="list-style-type: none"> 1. Experience the application of facial recognition. 2. Master the drawing of stage background in DobotScratch. 3. Master the drawing of a role in DobotScratch. 4. Master the method for communication between roles. 	3	
Intelligent Navigation	<p>General task: Program to conduct the task of waking up the robot and path planning.</p> <p>Task 1: Awaken the Robot</p> <p>Task 2: Intelligent Navigation</p>	<ol style="list-style-type: none"> 1. Grasp speech recognition instructions. 2. Be skilled in creating a variable and be able to use the variable. 3. Be familiar with the branch structure and loop structure. 	2	

<p>Making a hamburger</p>	<p>General task: Program to make delicious burgers automatically with the robotic arm</p> <p>Task 1: Design the Bun Model</p> <p>Task 2: Design Models of Vegetables and Meat Slices</p> <p>Task 3: Enable the Robotic Arm to Make Delicious Hamburgers</p>	<ol style="list-style-type: none"> 1. Understand the main user interface (UI) of the Tinkercad software. 2. Master the methods for creating basic geometries and adjusting them through Tinkercad. 3. Master the basics of slicing through Ultimaker Cura. 4. Learn to adjust the printer and print the model. 5. Learn and master the method for drawing geometries through Tinkercad. 6. Understand image recognition technology and be skilled in using image recognition instructions. 7. Master how to simplify the program and understand the function of customizing blocks. 	<p>3</p>	
<p>AI Waiter</p>	<p>General task: Learn speech recognition technology and simulate a smart bar</p> <p>Task 1: Design the Cup Model</p> <p>Task 2: Design the Saucer Model</p> <p>Task 3: Program the Saucer Model</p> <p>Task 4: Program the Cup Clamp Model</p> <p>Task 5: Design the Bar Counter</p>	<ol style="list-style-type: none"> 1. Understand the shortcut keys for copying and pasting models on Tinkercad. 2. Master the alignment function on Tinkercad. 3. Be skilled in using Tinkercad to complete modeling tasks. 4. Learn the graphical programming-based modeling function, to program modeling of the cup holder. 5. Analyze the similarities and differences between conventional modeling methods and programming- 	<p>5</p>	

		<p>based modeling methods.</p> <p>6. Design the end of the cup fixture to explore the diversification of the end of the robot arm.</p> <p>7. Learn the graphical programming-based modeling function, to program modeling of the cup fixture.</p>		
Auto Order Pickup and Purchase in Supermarket	<p>General task: Automatically select goods with the robotic arm</p> <p>Task 1: Query of Commodity Information</p> <p>Task 2: Auto Commodity Pickup</p>	<p>1. Master the basic operations of the role interface.</p> <p>2. Master the use of entries.</p> <p>3. Be skilled in using OCR recognition and variable instructions.</p> <p>4. Program random running by the vehicle on the three lanes.</p> <p>5. Program to implement automatic selection of goods with the robotic arm.</p>	2	
"Auto-Medicine Vending Robot"	<p>General task: Experience the application of facial recognition technology.</p> <p>Task 1: Draw the user interface (UI) for operations</p> <p>Task 2: Compile the scripting for each role</p> <p>Task 3: Take medicine and pay</p>	<p>1. Learn to draw roles.</p> <p>2. Learn to make a stage background.</p> <p>3. Learn the instruction to "Broadcast message".</p> <p>4. Experience the technology for communication between robot and computer.</p>	3	

Smart Checkout	<p>General tasks: Complete automatic pricing and payment</p> <p>Task 1: Automatic pricing</p> <p>Task 2: Automatic payment</p>	<p>1. Master the speech recognition technology, facial recognition technology, and OCR text recognition technology.</p> <p>2. Be skilled in using speech recognition, facial recognition, and OCR text recognition instructions.</p> <p>3. Be skilled in using variables and master the logic operations.</p>	2	
Giving Presents	<p>General task: Identify the gender through facial recognition and give gifts to boys and girls by gender</p> <p>Task 1: Present Delivering</p> <p>Task 2: Application of Face Attributes</p>	<p>1. Be skilled in using facial recognition instructions.</p> <p>2. Be skilled in using control, operation, and variable instructions.</p> <p>3. Program the implementation of facial recognition and personalized gift giving.</p>	2	

4. AI Farm

This experiment topic is recommended for grade-6 students with a total of 24 class sessions. By simulating the process from farm planting to crop picking, enable students to perceive and experience the application of automatic control technology and robot perception technology in the AI field in daily life.

Experiment Subject	Experiment Task	Objectives	Sessions	Remarks
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Smart sowing	<p>General task: program the implementation of continuous sowing and multiple sowing</p> <p>Task 1: Sow three times</p> <p>Task 2: Sow multiple times</p>	<ol style="list-style-type: none"> 1. Be skilled in using Arduino IDE. 2. Understand the relevant knowledge of Arduino Mega 2560 control board. 3. Master the macro definition and the use of the "if" statement. 4. Master the use of the "while" loop. 	2	
Automatic supplementary lighting	<p>General task: Program the RGB light intensity adjustment task.</p> <p>Task 1: Make LED Running Lights</p> <p>Task 2: Make Breathing Lights</p> <p>Task 3: Detect Light Intensity</p> <p>Task 4: Adjust the Light Intensity</p>	<ol style="list-style-type: none"> 1. Understand the instructions to control RGB lights. 2. Design the lighting sequence of RGB running lights. 3. Design the method for controlling RGB breathing lights. 4. Learn about light sensors. 5. Understand the relevant instructions of light sensors. 6. Understand light intensity data. 7. Understand the branch structure in Arduino programming. 	4	RGB, light sensor
Smart Temperature Control	<p>General task: Simulation the temperature control system</p> <p>Task 1: Read Values of the Temperature and Humidity Sensors</p> <p>Task 2: LCD Screen Displays Temperature and Humidity Sensor Parameters</p> <p>Task 3: Design a Cooling System</p> <p>Task 4: Design the Heating System</p> <p>Task 5: Design A Temperature Control System</p>	<ol style="list-style-type: none"> 1. Master the instructions to define variables. 2. Understand relevant instructions of temperature and humidity sensors. 3. Master the LCD display related instructions. 4. Master DC Motor related instructions. 5. Understand RGB module related instructions. 6. Understand multi-branch structures. 	5	Temperature and humidity sensors, RGB, LCD, fan

Watering	<p>General task: Establish an automatic watering system</p> <p>Task 1: Get the Soil Humidity Value</p> <p>Task 2: Display the Soil Humidity on LCD1602</p> <p>Task 3: Control the Pump to Draw Water</p> <p>Task 4: Design the End of the Robotic Arm</p> <p>Task 5: Build the Automatic Watering System</p>	<ol style="list-style-type: none"> 1. Master the application of the soil temperature and humidity sensors. 2. Master how to design a 3D model. 3. Learn how to use the display. 4. Master the use of the steering gear. 	5	Soil moisture sensor, LCD, steering gear, water pump, power relay
Smart Picking	<p>General task: Program the radish picking task.</p> <p>Task 1: Pick a Radish</p> <p>Task 2: Pick one row of radishes</p> <p>Task 3: Pick one radish field</p> <p>Task 4: Pick two radish fields</p>	<ol style="list-style-type: none"> 1. Be skilled in using motion instructions. 2. Be skilled in using macro definitions, while loop statements, for loop statements, and nested loops. 3. Understand and be able to derive the coordinate change formula. 	4	
Automatic Sorting	<p>General task: Write programs to realize picking and sorting by the robotic arm.</p> <p>Task 1: Design the Radish Model</p> <p>Task 2: Design the Radish Basket Model</p> <p>Task 3: Display the RGB value on the serial port</p> <p>Task 4: Sort Radishes</p>	<ol style="list-style-type: none"> 1. Master programming skills in Tinkercad. 2. Be skilled in using basic shapes to establish a model. 3. Learn how to use color sensors. 4. Be familiar with the basic syntax of Arduino. 	4	Color sensor

