Agilex Cobot Magic Data Collection Tasks

Notes:

- Number of episodes collected for each task: 50
- Single-arm tasks default to right hand
- Unsuccessful episodes can also be recorded, not exceeding 20%
- Advanced version or -v (variation) as alternative tasks
- Desktop scene must be within the camera's field of view
- Before each task collection, familiarize yourself with the operation of the robotic arm
- For each task, shoot a third-person perspective video to demonstrate the operation process
- After completing each task collection, provide feedback and fill out a survey regarding task difficulty
- For safety, there must be at least two people present at the experiment site; it is recommended that one person controls the robot to complete the task via teleoperation, while the other is responsible for running the data collection script (see 'Data Collection Operation Instructions' for details).

Desktop-Level Operation

Task 1: Common Fruit Grasping
Text Description (Instruction): "Put the apple/banana into the basket"
Task Description: Several types of fruit props are scattered on the desktop, along with a fruit basket. The robotic arm will grasp the corresponding fruit according to the instruction and then place it into the fruit basket. If any fruit falls during the process, it will be considered a failure for that collection attempt, and the attempt will end. This attempt can be used as a failure sample, and the desktop scene must be within the camera's field of view.
Task Difficulty Analysis: Easy. **Single-arm grasping, moving, and placing** (pick and place). The operator will provide feedback on the difficulty after completing the task.
Initial Conditions: Fruits are randomly placed on the desktop. The position of the fruits can be random. The robotic arm is in the starting position.
Terminal Condition: Place the corresponding fruit into the fruit basket.
Props: Fruit basket, simulation fruit, tablecloth

Task 1-v: Common Fruit Grasping
Text Description (Instruction): "Put the banana into the basket"
Task Description: Several types of fruit props are scattered on the desktop, along with a fruit basket. The robotic arm will grasp the corresponding fruit according to the instruction and then place it into the fruit basket. If the fruit falls during the process, it is considered a failure for that collection and ends; this collection can be treated as a failure sample.

Task Difficulty Analysis: Easy. **Single-arm grasping, moving, and placing** (pick and place). The operator will provide feedback on the difficulty after completing the task.
Starting Condition: Fruits are placed randomly on the desktop.
Terminal Condition: Place the corresponding fruit into the fruit basket.
Props: Fruit basket, simulation fruit, tablecloth

Task 2: Turn on the small desk lamp on the desktop
Text Description (Instruction): "Turn on the desk lamp by pressing the button"
Number of samples to collect: 50
Task Description: There is 1 small desk lamp fixed on the desktop, the plug is already inserted but not turned on; the robotic arm presses the lamp button to turn it on. Refer to the image below.

Task Difficulty Analysis: Easy, **Single-arm operation, no need to move**
Starting Condition: The robot is in front of the table, the desktop is empty, and there is only one small lamp placed in a location that the robot can reach without moving. The position of the lamp can vary each time.
Terminal Condition: The robot presses the button with one hand, and then the robotic arm returns to the default position.
Props: Lamp

Task 3: Clean the Desktop
Text Description (Instruction): "Cleaning the table by wiping it with a cloth and removing any debris (with one hands)"
Task Description: There are some crumbs and stains on the desktop. A cloth is placed in the upper left corner of the table. The robotic arm grabs the cloth and uses it to wipe the desktop starting from one end to the other, removing all crumbs and stains.
Task Difficulty Analysis: Easy. Mainly a simple **single-arm operation** .
Initial Condition: There are debris and stains on the desktop, and a cloth is located in the upper left corner.
Terminal Condition: The desktop is clean and free of debris and stains.
Props: Cloth

Task 4: Stacking Cups

Text Description (Instruction): "Stack the cups"

Task Description: There are 3 plastic or paper cups scattered on the desktop. The robotic arm should pick up the cups one by one and stack them, as shown in the diagram.

Task Difficulty Analysis: (Easy, Medium, Hard; the operator will provide an assessment after completion)

Initial Condition: Plastic cups are scattered on the desktop in random positions, and the robotic arm is in the default position.

Terminal Condition: Stack the cups on the table

Props: Plastic cups or paper cups, coffee cups, etc., preferably in color

Task 5: Unscrew the bottle cap

Text Description (Instruction): "Twist open the cap of the vitamin bottle "

Task Description: There is a bottle with a cap containing vitamin tablets on the desktop. The robotic arm needs to use one hand to hold the bottle body and the other hand to grasp the cap and rotate it counterclockwise to unscrew the cap, while keeping the bottle stable and not tipping over. (Can be replaced with a mineral water bottle)

Task Difficulty Analysis: Medium. **Bilateral cooperation, twisting**

Initial Condition: There is a bottle containing vitamin pills on the desktop, the bottle cap is tightly screwed on, and its position is random.

Terminal Condition: Successfully unscrew the bottle cap and place it on the table.

Props: Vitamin Pill Bottle (already available)

Task 6: Use the keyboard to type the word "hello"

Text Description (Instruction): "Type the word 'hello' on a keyboard (with one hand)"

Task Description: The robotic arm needs to use one hand to sequentially press the letter keys 'h', 'e', 'l', 'l', 'o' on the keyboard to input the word 'hello'. Throughout the process, it is necessary to ensure accurate positioning of each

key and that they are all pressed correctly, with appropriate pressure to avoid repeated inputs or missed inputs.
Task difficulty analysis: Medium。 **Single-arm** Multi-step operation, press
Starting condition: A keyboard is placed on the tabletop, and the robotic arm is positioned in front of the keyboard, with the keyboard in working condition.
Terminal condition: Successfully press the letter keys 'h', 'e', 'l', 'l', 'o', and then the robotic arm returns to the default position.
Props: Keyboard

Task 7: Folding Towel
Text Description (Instruction): "Folding towels neatly and placing them on the center of the table (with two hands)"
Task description: The robotic arm needs **coordinated operation** with both hands to neatly fold the towel in half and place it in the center of the table.
Task difficulty analysis: Medium. Requires a certain level of coordination.
Starting condition: The towel is randomly placed on the table without being folded.
Terminal condition: The towel is neatly folded in half and placed in the center of the table.
Props: Towel

Task 8: Install Battery
Text Description (Instruction): "Installing batteries into a device, ensuring they are correctly oriented (with two hands)"
Task description: There is an electronic device (such as a remote control) that requires a battery to be installed. The robotic arm needs **coordinated operation** with both hands, one hand holding the device steady while the other hand installs the battery in the correct positive and negative orientation.
Task difficulty analysis: Medium. Requires a certain level of precision and accuracy.
Starting condition: The area where the electronic device (remote control, etc.) needs the battery installed is exposed, and the battery and electronic device are randomly placed on the tabletop.
Terminal condition: The battery is correctly installed in the device and operates normally.
Props: Electronic device, battery

Task 8-V: Insert the plug
Text Description (Instruction): " Plug the triangular plug into the socket"
Task description: There is a power strip placed on the table, positioned randomly, fixed to the tabletop (it is better to use double-sided tape for easier operation), along with a triangular plug. The robotic arm needs to grasp the plug, align it, and insert it into the power strip.
Task difficulty analysis: Medium. Requires a certain degree of **precision and**

accuracy, and needs to **continuously apply force to the environment.**
Starting condition: The plug is randomly placed on the tabletop, and the robotic arm is in the starting position.
Terminal condition: Plug inserted into the power strip.
Props: Electronic device, battery

Task 9: Apply ointment
Text Description (Instruction): "Applying ointment to a person's skin by gently spreading it with a finger (with two hands)"
Task description: The robotic arm needs **human-machine collaboration** , the robotic arm's right hand holds the opened ointment, the elderly person extends a hand to expose the area that needs ointment, placed within the working space of the robotic arm, the robotic arm will apply the ointment to the skin area of the elderly person that requires it.
Task difficulty analysis: Medium. Requires a certain level of **precision and coordination.**
Starting condition: The area on the elderly person's body that needs ointment.
Terminal condition: Ointment is evenly applied to the skin.
Props: Ointment

Task 10: Tear open the envelope
Text Description (Instruction): "Tear open an envelope (with two hands)"
Task description: There is a sealed envelope on the tabletop. The robotic arm needs to use one hand to grasp the envelope, while the other hand holds one corner or the seal of the envelope, and with appropriate force, tears it open. During the tearing process, it is necessary to ensure that the contents inside are not damaged.
Task difficulty analysis: Medium. **Bimanual collaboration, fine motor skills.**
Starting condition: A sealed envelope is placed on the tabletop in a random position.
Terminal condition: Successfully tear open the envelope while ensuring the contents are intact, then the robotic arm places the envelope down and returns to the default position.
Props: Envelope

Task 11: Pick up the pencil and write
Text Description (Instruction): "Pick up the pencil on the table and write down the number "1" on the paper."
Task description: There is a piece of white paper fixed on the tabletop. To distinguish the white paper from the tabletop background, a patterned tablecloth is laid on the tabletop; there is also a pencil on the table. The robotic arm needs to use one hand to pick up the pencil and write the number '1' in the center of the paper.
Task difficulty analysis: Easy, **single-arm operation,** requires applying a

certain amount of force to the environment.
Starting condition: The robotic arm faces the tabletop, which has a piece of white paper and a pencil on it. The positions of the white paper and pencil can be randomized for each collection.
Terminal condition: Write the number '1' on the white paper.
Props: White paper, Pencil

Task 11-v: Pick up the pencil and write
Text Description (Instruction): "Pick up the pencil on the table and write down the letters "P C L" on the paper."
Task description: There is a piece of white paper fixed on the tabletop. To distinguish the white paper from the tabletop background, a patterned tablecloth is laid on the tabletop; there is also a pencil on the table. The robotic arm needs to use one hand to pick up the pencil and sequentially write the letters 'P, C, L' in the center of the paper.
Task difficulty analysis: Medium, **single-arm operation,** requires applying a certain force to the environment, the task includes multiple steps.
Starting condition: The robotic arm faces the tabletop, which has a piece of white paper and a pencil on it. The positions of the white paper and pencil can be randomized for each collection.
Terminal condition: Write the letters 'P, C, L' on the white paper.
Props: White paper, Pencil

Task 11-1 (Advanced version) Pick up the brush and write
Text Description (Instruction): "Pick up the pencil on the table and write down the letters "P C L" on the paper."
Task description: A piece of rice paper is laid out on the tabletop. The right claw of the robotic arm holds a brush dipped in ink, needs to move the robotic arm to make contact with the paper, apply appropriate force, and sequentially write the letters 'P, C, L' in the center of the paper.
Task difficulty analysis: hard, **Single-arm operation**, requires applying a certain force to the environment, the task involves **multiple steps and is long-horizon task.**
Starting condition: The robotic arm faces the tabletop (position can be random), a piece of rice paper is laid out on the tabletop, and the right hand of the robotic arm is in the initialization position, holding a brush dipped in ink.
Terminal condition: Write the letters 'P, C, L' on the white paper.
Props: Brush, Ink, Rice paper

Task 12: Tabletop rearrangement
Text Description (Instruction): " "Grab the book, pencil, and eraser from the upper right corner of the table and arrange them as follows: place the book in the center of the surface, the pencil to the right of the book, and the eraser to the left of the book."

Task description: Books, pencils, and erasers are randomly placed in the upper right area of the tabletop. Move the right robotic arm to first grab the book and place it in the center of the tabletop, then grab the pencil and place it to the right of the book, and finally grab the eraser and place it to the left of the book.
Task difficulty analysis: Medium, **Single-arm operation,** Long sequence.
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. Books, pencils, and erasers are randomly placed in the upper right area of the tabletop, within the field of view.
Terminal condition: A book is placed in the center of the tabletop, with a pencil on the right side of the book and an eraser on the left side.
Props: Book, pencil, eraser

Task 13: Handover between left and right hands
Text Description (Instruction): "Pick up the red block on the table with the left hand and pass it to the right hand"
Task description: A red building block is placed on the tabletop, and the robotic arm needs to move the left hand to grasp the block on the table and hand it over to the right hand.
Task difficulty analysis: Medium, **requires bimanual collaboration .**
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. There is a red building block placed on the tabletop, the position can be random, but it must be within the field of view.
Terminal condition: The building block on the table is picked up and transferred to the right hand.
Props: Red building block (owned)

Task 13-v: The red building block can be replaced with other items, such as simulation fruit.

Task 14: Cut modeling clay.
Text Description (Instruction): " Please cut the playdough on the table in half."
Task description: There is an oval-shaped piece of modeling clay on the tabletop, next to it is a plastic knife. The robotic arm needs to move to grab the knife from the table and move it above the modeling clay, cutting the modeling clay into two halves at the appropriate position.
Task difficulty analysis: Medium, **Single-arm operation** , using a knife, applying force to the environment.
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. On the tabletop, there is a piece of modeling clay shaped like an oval, next to it is a plastic knife, the position can be random but must be within the field of view.
Terminal condition: The modeling clay is cut in half, and the robotic arm's right hand picks up the knife.

Props: Modeling clay (colored), plastic knife (can cut the modeling clay)

Task 15: Pick up blocks with both hands and strike
Text Description (Instruction): " Pick up the red building block with your left hand and the green building block with your right hand, then knock the two blocks against each other."
Task description: Several blocks (including red and white blocks) are placed on the tabletop. The robotic arm needs to move the left hand to grab the red block on the table, move the right hand to grab the white block on the tabletop, and then the two blocks should strike each other with a hitting motion.
Task difficulty analysis: Medium, **requires bimanual collaboration**, long sequence operation, and a certain amount of force must be applied.
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. There are several blocks placed on the tabletop, their positions can be random but must be within the field of view, including one red block and one green block.
Terminal condition: The red block on the table is picked up by the left hand, the green block is picked up by the right hand, and the two blocks strike each other and produce a knocking sound.
Props: Several blocks of different colors (self-provided)

Task 16: Use a spoon to scoop a spoonful of rice (milk powder, mung beans, etc.)
Text Description (Instruction): " Scoop a spoonful of rice from the container."
Task description: A plastic bowl is placed on the tabletop, containing more than half a bowl of rice, with a spoon beside it. The robotic arm needs to move its arm to grab the spoon and scoop a spoonful of rice from the bowl.
Task difficulty analysis: Medium, **requires single robotic arm twisting operation,** and applies a certain force to the environment.
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. On the tabletop, there is a plastic bowl filled with more than half a bowl of rice, and next to it, there is a spoon.
Terminal condition: The spoon is picked up and a spoonful of rice is scooped from the bowl.
Props: Plastic container (such as a bowl), spoon, rice (can be self-provided)

Task 17: Unzip the zipper
Text Description (Instruction): " Please unzip the purse. "
Task description: There is a bag on the tabletop with the zipper closed. The robotic arm needs to move the left arm to grab the wallet, move the right arm close to the wallet, and unzip the zipper.
Task difficulty analysis: Medium, **Bimanual collaboration.** Requires the robotic arm to continuously exert a certain force on the environment.
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. A zipped bag is placed on the tabletop.

Terminal condition: The wallet is picked up, and the zipper is unzipped.
Props: A bag with a zipper. (Self-owned)

Task 18: Pick up a grape (or fine objects like small balls)
Text Description (Instruction): " Grab a grape from the table and put it into the basket "
Task description: Scatter several grapes and other fruits on the tabletop, along with a fruit basket. The robotic arm will grasp the corresponding fruit according to the instruction and then place it into the fruit basket. If the fruit falls during the process, it is considered a failure for that collection and ends; this collection can be treated as a failure sample.
Task difficulty analysis: Medium. Single-arm pick and place movement, fine manipulation, **soft object handling**. The operator provides feedback on the difficulty after completing the task.
Starting Condition: Fruits are placed randomly on the desktop.
Terminal condition: Place the corresponding fruit into the fruit basket.
Props: Fruit basket, grape (simulation or physical), tablecloth

Task 19: Turn the pages of a book
Text Description (Instruction): "Turn a page of a book (with one hand)"
Task description: There is an open book on the tabletop. The robotic arm needs to gently grasp the edge of the page with **one hand** and turn it from left to right or from right to left. During the page-turning process, it is necessary to ensure that the page does not tear or get damaged, and the motion should be gentle and smooth.
Task difficulty analysis: Medium.
Starting condition: An open book is placed on the tabletop, with the page position random.
Terminal condition: Successfully turn the page to the next or previous page, ensuring the page is flat and undamaged, then the robotic arm returns to the default position.
Props: Book (self-owned)

Task 20: Place the small ball (or grape, etc.) into the mineral water bottle
Text Description (Instruction): " Pick up the little ball in the container and put it into the mineral water bottle"
Task description: There is an open empty mineral water bottle on the tabletop, next to it is a plastic container, which contains a small plastic ball (diameter less than the opening of the mineral water bottle). Move the robotic arm above the plastic container and grasp the small ball, then move the ball to the opening of the mineral water bottle. During the movement, there should be no collisions. After aligning, release the robotic arm's gripper to let the ball fall into the mineral water bottle.
Task difficulty analysis: Medium. **Single-arm precise object grasping.**

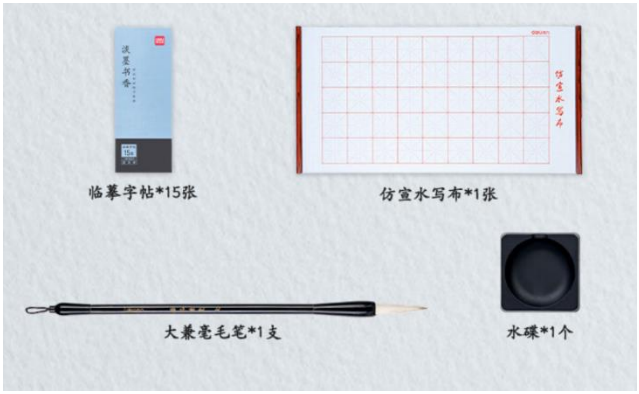
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. On the tabletop, there is an open empty mineral water bottle, and next to it is a plastic container (position random), which contains a colored plastic ball (diameter less than the mouth of the mineral water bottle).
Terminal condition: Successfully grasp the ball from the container, the container is empty, and the ball falls into the mineral water bottle through the mouth.
Props: ball, mineral water bottle, plastic container

Task 21: Stacking blocks
Text Description (Instruction): " Place the red block on top of the white block."
Task description: On the tabletop, there is a red building block and a white building block, possibly containing other items. The robotic arm needs to move the right hand to grasp the red building block on the tabletop and then place it on top of the white building block.
Task difficulty analysis: Medium, **Single-arm fine operation.**
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. On the tabletop, there are red building blocks and white building blocks, as well as several interfering objects, the positions can be random, but must be within the field of view.
Terminal condition: The red building block on the table is placed on top of the white building block and has not fallen.
Props: Several blocks of different colors (self-provided)

Task 22: Turn off the small desk lamp on the tabletop.
Text Description (Instruction): "Turn off the desk lamp by pressing the button"
Task description: There is 1 small desk lamp on the tabletop, fixed in place, the plug is already plugged in, the lamp is on, the robotic arm presses the lamp button to turn it off.
Task Difficulty Analysis: Easy, **Single-arm operation, no need to move**
Starting condition: The robot is in front of the table, there is a small desk lamp that is on, placed in a location where the robot can touch it without needing to move, and the position of the lamp can vary each time; there may be other items on the tabletop.
Terminal Condition: The robot presses the button with one hand, and then the robotic arm returns to the default position.
Props: Lamp

Task 23: Tabletop Rearrangement of the Four Treasures of Study
Text Description (Instruction): " The right robotic arm first picks up the rice paper and places it on the upper right side of the desk, then picks up the water dish and places it on the lower right side of the desk, and then picks up the brush and places it in the lower left corner, finally picks up the calligraphy copybook and places it above the brush. "

Task description: The upper left area of the tabletop is randomly placed with rice paper, brush, copybook, and water butterfly. First, move the right robotic arm to grasp the rice paper and place it in the upper right area of the tabletop, then grasp the water butterfly and place it in the lower right corner, grasp the brush and place it in the lower left corner, and finally grasp the copybook and place it above the brush. (As shown in the figure below)
Task difficulty analysis: Medium to hard, **Single-arm operation, Long sequence.**
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. The upper left area of the tabletop is randomly placed with rice paper, brush, copybook, and water butterfly, and must be within the field of view.
Terminal condition: Arrange the items as shown in the figure below.



Task 24: Hand-off between left and right hands
Text Description (Instruction): "Pick up the pencil on the table with the left hand and pass it to the right hand"
Task description: A pencil is placed on the tabletop, the robotic arm needs to move the left hand to grasp the pencil on the table and hand it over to the right hand.
Task difficulty analysis: Medium, requires bimanual collaboration .
Starting condition: The robotic arm faces the tabletop, and the left and right hands are in the starting position. A pencil is placed on the tabletop, the position can be random, and there may be other objects, but it must be within the field of view.
Terminal condition: The pencil on the table is picked up and passed to the right hand.
Props: Pencil

Task 25: Laying the tablecloth
Text Description (Instruction): "Laying out a tablecloth on a table, ensuring it is centered and smooth (with two hands)"
Task description: The robotic arm needs to **cooperate with both hands** to lay the tablecloth on the table, ensuring the tablecloth is centered and smoothing out any wrinkles.

Task difficulty analysis: Medium. Requires a certain level of **precision and coordination.**
Starting condition: The tablecloth is folded aside (top left corner).
Terminal condition: The tablecloth is laid on the table, centered and flat.

Task 26: Tighten the bottle cap
Text Description (Instruction): ″ Tighten the cap of the vitamin bottle ″
Task description: There is a bottle containing vitamin tablets on the tabletop, with a bottle cap beside it. The robotic arm needs to use one hand to grasp the bottle body, and the other hand to grasp the bottle cap and rotate it clockwise to tighten the cap, while ensuring the bottle remains stable and does not tip over.
Task Difficulty Analysis: Medium. **Bilateral cooperation, twisting**
Starting condition: There is a bottle containing vitamin pills on the tabletop, with a bottle cap next to it, positioned randomly.
Terminal condition: Successfully tighten the bottle cap and place it on the tabletop.
Props: Vitamin Pill Bottle (already available)

Task 27: Open the medicine bottle and pour the medicine
Text Description (Instruction): ″Open the vitamin bottle and pour the pills into the plastic bowl.″
Task description: Use one hand to stabilize the medicine bottle, while the other hand opens the bottle cap, then pour the vitamin tablets into the plastic bowl.
Task difficulty analysis: Medium. **Requires bimanual collaboration and fine manipulation.**
Starting condition: There is a plastic medicine bottle containing vitamin tablets on the tabletop, with the bottle cap tightly closed, and a plastic bowl next to it.
Terminal condition: Vitamin tablets are evenly poured into the plastic bowl

Task 28: Catch the item handed over by a person
Text Description (Instruction): ″ Grasp the vitamin bottle handed over by someone with the right hand.″
Task description: The robot moves its right robotic arm to catch the vitamin bottle handed over by a person.
Task difficulty analysis: Medium. Requires **human-robot collaboration** .
Starting condition: A person stands next to the robotic arm, holding a vitamin bottle (within the robot's field of view), and the robot is in the starting position.
Terminal condition: The vitamin bottle is passed from the person's hand to the right robotic arm and is securely grasped.

Task 29: Handover the item to a person

Text Description (Instruction): ″ Hand over the vitamin bottle in the right hand to the person standing next to the robot.″
Task description: The robot moves its right robotic arm to hand the vitamin bottle in its right hand to the person beside.
Task difficulty analysis: Medium. Requires **human-robot collaboration.**
Starting condition: A person is standing beside the robotic arm and extending their hand (within the robot's field of view), and the robot has a robotic arm holding the vitamin bottle.
Terminal condition: The vitamin bottle is transferred from the robotic arm to the person's hand.

Task 30: Simulate restaurant service
Text Description (Instruction): ″ Place the plastic spoon on the bowl.″
Task description: Simulate a restaurant service scenario by placing the plastic spoon on the plastic bowl.
Task difficulty analysis: Easy. Requires precision in **placement** .
Starting condition: There is a plastic bowl, a plastic spoon, and other items on the tabletop, positioned randomly, and the robotic arm is in the starting position.
Terminal condition: The plastic spoon is correctly placed on the plastic bowl.

Task 31: Simulate reading by picking up the book
Text Description (Instruction): “Pick up the open book on the table with both hands.”
Task description: An open book is placed on the tabletop, and the robot simultaneously moves its left and right robotic arms to grasp the left and right pages of the book, lifting the book off the tabletop and positioning it within the field of view of the forward-facing camera.
Task difficulty analysis: medium. **Bimanual collaboration.**
Starting condition: There is an open book on the tabletop, positioned randomly, and the robotic arm is in the starting position.
Terminal condition: The book is picked up by two robotic arms, removed from the tabletop, and placed vertically, simulating reading, facing the front camera.