Lesson Planning Template **Teacher: DeSIRE**

📆Date:	**Topic: Setup Development Environment**	**Time Required: 90 minutes**

🎯**Learning Target/Objectives:**

- **I can** implement standard safety protocols to protect both the operator and the precision mechanical components of the robotic arm .
- **I can** differentiate between various electronic sensors and explain how they convert environmental stimuli (light, sound, touch) into electrical signals for a controller .
- **I can** execute a multi-step hardware initialization sequence, including program downloading and physical kit connection .

📜**Vocabulary:**

- Secondary Development Kit
- Precision Mechanical Components
- Ultrasonic Sensor
- Analog Quantity
- Threshold
- Piezoelectric Crystals

❓**Guiding Questions:**

- Why is it critical to reset or reload a program before turning on the power to the robotic arm ?
- How does an IR Obstacle Avoidance sensor differ from an Ultrasonic sensor in terms of what environmental "data" it collects ?
- In what ways can a light sensor's "threshold" be used to automate a home security system?

📚**Lesson Design Details:**

- **Activity 1: The Safety Auditor**
  - **Focus:** Students create a visual "Safety Zone" poster for the xArm. They must list the five general precautions and explain the "Accidental Movement" risk associated with power-on .
- **Activity 2: Sensor Identification Scavenger Hunt**
  - **Focus:** Using the Sensor Introduction section, students are given various objects (a flashlight, a buzzer, a block). They must match which of the six sensors (Touch, Sound, IR, Ultrasonic, Light, Color) would be best suited to detect each object .
- **Activity 3: The Ultrasonic Transit (Distance Math)**
  - **Focus:** Students use the ultrasonic sensor specs to calculate how fast the transmitter and receiver cycle works. They simulate the path of the "reflected sound" to understand electrical signal conversion.

Key Points (Vocabulary):

- **Secondary Development Kit:** An expansion board (UNO R3) used to add advanced programming and sensor capabilities to the robot .
- **Precision Mechanical Components:** High-accuracy parts within the servo that require careful handling to avoid damage.
- **Ultrasonic Sensor:** A device that measures distance by emitting sound waves and timing the reflection (echo) .
- **Analog Quantity:** A continuous signal where the detected value (like sound) is proportional to the output voltage.
- **Threshold:** A specific value that, when reached, triggers a change in the sensor's digital output.
- **Piezoelectric Crystals:** Components within the ultrasonic transmitter that convert electrical energy into sound waves.

Key Points of Instruction

- **Mechanical Integrity:** Servos are precision tools. Emphasize that twisting joints manually while power is on can strip internal gears .
- **Thermal Management:** Servos heat up during use. Teach students to perform "touch tests" on motor casings; if it's hot, the system needs a cooling break.
- **Connection Sequence:** The 4PIN wire is the communication bridge between the robot and the UNO development kit. If this is not secure, sensor data will not reach the servos .
- **Digital vs. Analog Signals:** Use the sound sensor (proportional analog output) and the light sensor (0/1 threshold digital output) to explain how robots interpret the world differently depending on the sensor used.

Teacher's Cheat Sheet

Category	Instruction / Data Point
Download Target	UNO R3 controller.
Connection Type	4PIN wire for hardware link.
Servo Warning	Switch off if servos become hot.
IR Tuning	Clockwise increases intensity; Counterclockwise decreases.

Sound Output	Proportional to detected intensity.
Light Logic	Output 0 if above threshold; 1 if below.
Color Detection	Detects Red, Blue, and Green intensities.

Category	Standard Organization	Standard/Benchmark Code and Description
Technology	ITEEA	STEL-2R: Follow step-by-step instructions to safely use systems and troubleshoot common problems.
Computer Science	NCSOS	HS-CS-03: Illustrate the ways computing systems implement logic, input, and output through hardware components.
Engineering	ITEEA	STEL-2V: Analyze the stability of a technological system and how it is influenced by components in the feedback loop.
Digital Literacy	ISTE	1.1 Empowered Learner: Students demonstrate a sound understanding of technology concepts, systems, and operations.
Science	NCSOS	PHY.2.1.1: Analyze the motion of objects.