

## Microcontroller Setup Instructions

### 1. Install Arduino IDE:

- Download and install the Arduino IDE from [arduino.cc](https://www.arduino.cc).

### 2. Install Required Libraries:

- Open Arduino IDE.
- Go to **Sketch > Include Library > Manage Libraries**.
- Search for and install:
  - **Servo**

### 3. Connect Components:

- **Proximity Sensor:** Connect the signal pin to a GPIO pin (e.g., D1 on ESP8266).
- **Servo Motor:** Connect the control pin to a GPIO pin (e.g., D2 on ESP8266).
- **DRV8825 Driver:**
  - Connect STEP to GPIO (e.g., D6), DIR to GPIO (e.g., D7), and ENABLE to GND or a control pin.
  - Provide appropriate power (5V logic, 12V for the motor).
- **Power Supply:** Ensure the microcontroller and motors have stable power. Use common GND.

### 4. Configure Arduino IDE for ESP8266:

- Install the ESP8266 board package:
  - Go to **File > Preferences**.
  - Add this URL to **Additional Board Manager URLs**:  
[http://arduino.esp8266.com/stable/package\\_esp8266com\\_index.json](http://arduino.esp8266.com/stable/package_esp8266com_index.json)
  - Go to **Tools > Board > Board Manager**, search for ESP8266, and install it.

### 5. Upload Code:

- Connect the microcontroller via USB to your computer.
- Select the correct **board** and **port** in **Tools**.

- Click **Upload** to flash the code to the microcontroller.

## 6. Test and Debug:

- Open the Serial Monitor in the Arduino IDE to view debugging messages.
- Verify that the proximity sensor, servo motor, and stepper motor respond correctly to inputs.

## Summary of Statement 4

### Additional Features

1. *Steerable Wheel Module: to change the direction of detected object*
2. IoT Integration: Real-time monitoring and analytics via cloud.
3. Adaptive Speed Control: Adjust conveyor speed dynamically.
4. Multiple Sorting Criteria: Add bins for more categories.

### Challenges and Solutions

1. Sensor Sensitivity: Use adjustable or optical sensors for better detection.
2. Classification Accuracy: Integrate advanced sensors or camera modules.
3. Motor Precision: Use micro stepping and high-torque motors.
4. Power Stability: Implement power management with voltage regulators.

### Component Selection

1. Inductive Proximity Sensor: For Reliable object detection.
2. Servo Motor: Precise angular control for sorting.
3. DRV8825 Driver: Micro stepping for precise stepper control.
4. Microcontroller (e.g., ESP8266): Handles logic.
5. Power Supply (5V): Stable and suitable for components.