WT - Exp - 3

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Project name: Object Segregator

Aim:

Develop an automated system that accurately separates objects into dry and wet categories, improving efficiency and reducing errors in processing.

Introduction:

Efficient classification of objects based on moisture content is crucial in industries such as agriculture, food storage, and material processing. Manual segregation methods are often time-consuming and prone to errors, leading to inefficiencies in handling and storage. This project focuses on developing an automated wet-dry object classification system that ensures precise, real-time segregation based on moisture levels, reducing human intervention and enhancing operational efficiency.

The system employs an ultrasonic sensor to detect the presence of an object and a soil moisture sensor to determine its moisture content. An Arduino-controlled motorized mechanism then categorizes the object as either wet or dry by rotating accordingly to direct it to the appropriate section. This solution offers improved accuracy, reduced labor dependency, and seamless integration into industrial workflows, making it an effective tool for optimized material handling and processing.

Objectives:

- **Automate Moisture-Based Classification**: Develop a system that accurately distinguishes between wet and dry objects without human intervention, ensuring precise sorting.
- **Enhance Efficiency and Accuracy**: Reduce manual effort and errors by implementing sensor-based decision-making for real-time object segregation.
- **Provide a Compact and Cost-Effective Solution**: Design a system without complex conveyor mechanisms, making it suitable for various industrial applications while maintaining affordability and ease of implementation.

Challenges:

- **Sensor Accuracy and Variability**: Different materials and textures may affect the soil moisture sensor's readings, requiring calibration for consistent performance.

- **Environmental Factors**: Changes in humidity and temperature can influence moisture readings, potentially impacting classification accuracy.
- **Precision in Sorting:** Ensuring that the motorized sorting mechanism precisely moves in the correct direction based on moisture readings is crucial for accurate segregation.

Solution Approach:

1. **Object Detection**: The ultrasonic sensor detects when an object is placed on the system.
2. **Moisture Measurement**: The soil moisture sensor determines the object's moisture content.
3. **Data Processing**: The Arduino processes the sensor readings and decides the category.
4. **Object Segregation**: A motorized mechanism, positioned behind the object, rotates left for wet objects and right for dry objects, directing them accordingly.

Scope:

- **Agriculture** – Sorting wet and dry produce.
- **Food Processing** – Segregating perishable and non-perishable goods.
- **Manufacturing & Logistics** – Ensuring moisture-sensitive materials are handled correctly.
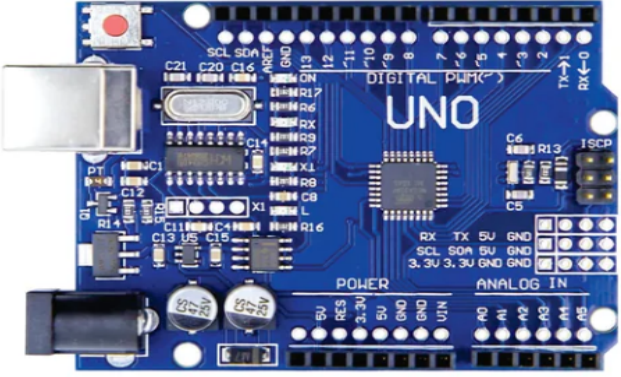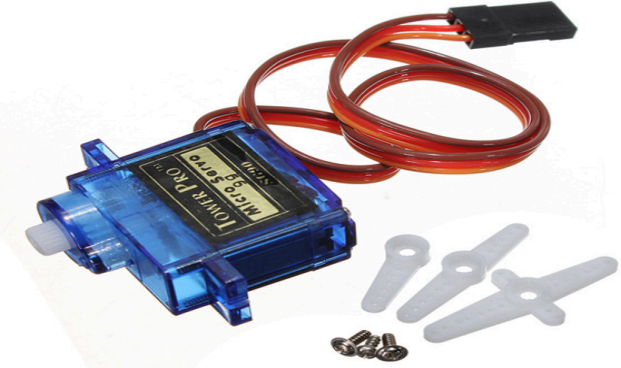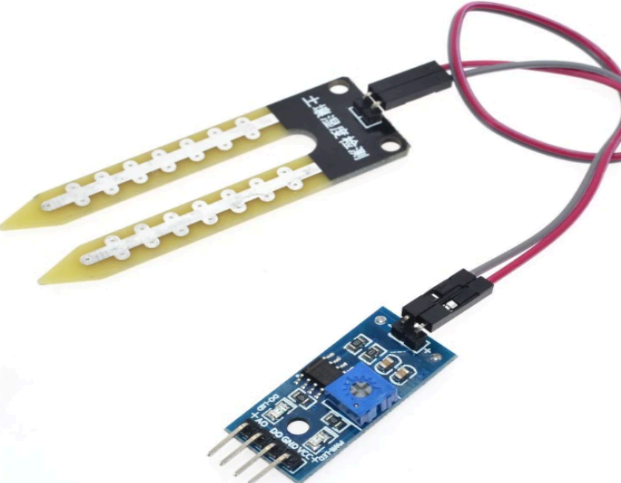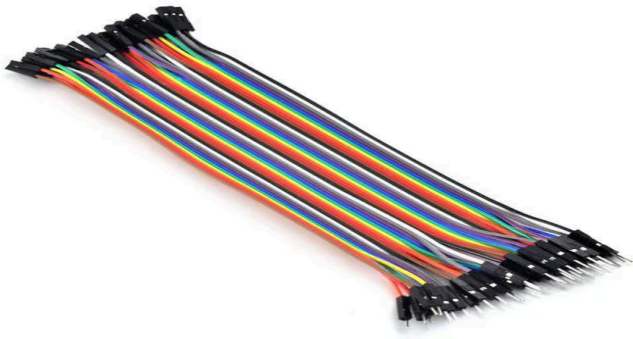
Advantages:

- **Automation Reduces Manual Effort:** Eliminates the need for manual classification, saving time and labor costs.
- **High Accuracy:** Uses real-time moisture readings for precise categorization.
- **Fast and Efficient:** Can sort objects instantly upon moisture detection.
- **Compact and Cost-Effective:** Simple design without the need for conveyor belts or complex mechanical structures.

Conclusion:

This Arduino-based automated system provides a practical, cost-effective, and efficient solution for moisture-based object classification. By integrating ultrasonic and soil moisture sensors with a motorized sorting mechanism, it ensures real-time and accurate segregation of objects into wet or dry categories. The project offers a scalable and adaptable approach to improving sorting processes across various industries, enhancing efficiency and accuracy while minimizing human error.

Components:

Sr no.	Description	Image
1.	**Arduino Uno SMD** A microcontroller board based on the ATmega328P, designed for embedded applications with digital and analog I/O pins. It processes data from sensors and controls the servo motor to classify objects as wet or dry.	
2.	**Servo 9g Motor** A small, lightweight servo motor capable of precise angular movement, typically used in automation and robotics. In this system, it rotates left or right to direct the object to its designated category.	
3.	**Soil Moisture Sensor** A capacitive/resistive sensor that detects the water content in an object by measuring electrical conductivity variations. It determines if the object is wet or dry, enabling accurate classification.	

4.	**Ultrasonic Sensor** A distance-measuring sensor that emits high-frequency sound waves and calculates the time delay of reflected waves. It detects the presence of an object, triggering the classification process.	
5.	**USB Cable** A standard cable used to supply power and enable data communication between the Arduino and a computer. It facilitates programming and real-time monitoring of the system.	
6.	**M-F Jumpers** Flexible connectors with male-to-female terminals that establish electrical connections between the Arduino, sensors, and motor. They ensure proper signal transmission and circuit functionality.	
7.	**Breadboard** A solderless prototyping board used for building and testing electronic circuits. It enables easy connections between the Arduino, sensors, and motor without permanent wiring.	