

EcoArm: Intelligent Sorting Arm for sustainable recyclingIdea description:

The base concept of this proposal is designing a robotic arm system capable of sorting different materials (plastic, aluminum, paper...) into their respective bins. That will require the use of computer vision to recognize the material, as well as a motorized system for movement and safe, efficient gripping. A camera will be used to capture images of the materials, then an image processing algorithm will identify the material and communicate the corresponding bin to the robotic arm, all communication and control done via an arduino microcontroller.

Functionality and technical overview:

The mechanical assembly consists of a lightweight robotic arm equipped with 17HS4401 stepper motors to achieve precise movements across multiple axes. The arm's end consists of a custom 3D-printed gripper specifically designed to handle different materials. To identify the material type, the system utilizes a camera mounted above the sorting area, which captures real-time images of the items. These images are processed using OpenCV (section 50.3 from the manual).

Once a material is identified, the Arduino Uno microcontroller coordinates the movement of the robotic arm by sending signals to the A4988 motor drivers guiding the arm to the correct location to pick up the material and place it into the designated bin, which could consist of a little wood box. The system is powered by a 12V power supply, providing consistent and adequate power for the motors, microcontroller, and other electronic components. The Arduino manages all control logic, processing the data from the camera, and translating it into precise motor movements, ensuring accurate sorting.

Usability and opportunities:

From a general user's perspective, this project could lead the way into a future of automated waste handling. It provides an educational experience, demonstrating how advanced technologies can be used to solve everyday simple problems. Looking ahead, it could lead to more advanced versions of automated sorting systems for industrial applications, on a larger more complex scale such as recycling centers.

Risk assessment:

Key risks include misclassification due to inconsistent lighting, motor malfunctions like overheating, and wear on mechanical components such as the gripper. These risks will be mitigated by using controlled lighting, regular calibration and testing of motors, and periodic maintenance of mechanical parts. Additionally, secure electrical connections and careful circuit design will ensure consistent system performance and reliability.

Bill of materials:

Item	Quantity	Price in chf	Total in chf
stepper + driver (17HS4401+A4988)	2	15	30
Arduino Uno	1	5	5
Camera (Logitech C270)	1	16	16
Power Supply	1	19	19
Total			70

*This bill is not complete and detailed, as wires, plugs and other components were not taken into consideration until this point.