

A system to automatically detect and collect garbage

29 August 2019, by Ingrid Fadelli



A demonstration of the system's distance approximation. Credit: Bansal et al.

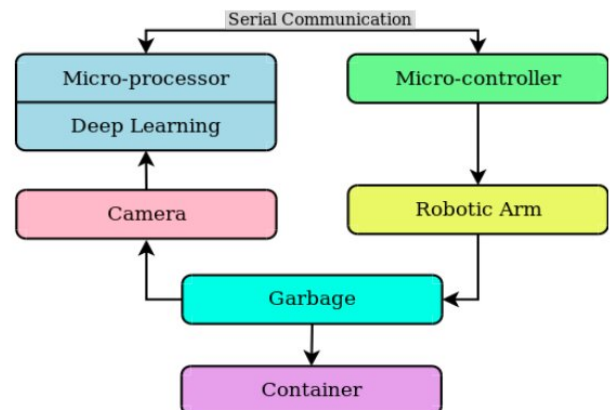
Numerous countries worldwide are currently facing major problems related to waste collection, particularly in urban areas, due to the large amount of waste generated daily by the population. Technology could play a significant role in tackling these issues, for instance, through the development of more effective tools to gather and collect garbage.

With this in mind, researchers at Vishwakarma Government Engineering College in India have recently created a cheap and effective system for automatic garbage detection and collection. Their system, presented in a paper pre-published on arXiv, uses artificial intelligence (AI) algorithms to detect and locate [waste](#) in its surroundings, then picks it up with a robotic gripper.

"Contemporaneous methods find it difficult to manage the volume of solid waste generated by the growing urban population," the researchers wrote in their paper. "We propose a system that is very hygienic and cheap that uses AI algorithms for detecting the garbage."

The waste management system, which the researchers refer to as AGDC (automatic garbage detection and collection), is composed of a robotic body (i.e. a base, a [robotic arm](#) and a drawer) and several machine learning algorithms. The system uses [convolutional neural networks](#) (CNNs) to detect rubbish on the ground and in its vicinity. Once it detects a piece of rubbish, it calculates its position by analyzing images collected by an integrated camera.

"Object detection refers to identifying instances of objects of a particular class (such as bottles, cat, dog or truck) in images and videos in digital format," the researchers explained. "AGDC uses object detection for classifying the garbage with the rest of the objects in the image/video. The object detection algorithm enables AGDC to identify places in the image or video where the object of interest (i.e. garbage) is resting."



Serial communication flow. Credit: Bansal et al.

Once the system's CNNs detect a piece of rubbish in its vicinity, another algorithm estimates the distance between the robot and the rubbish, while

also generating instructions for the robot to reach the target location. The position of the debris and these instructions are then fed to a microcontroller, which essentially controls the robot's movements.

"After completing the task of [object detection](#), the next task is to identify the distance of the object from the base of the robotic arm, which is necessary for allowing the robotic arm to pick up the garbage," the researchers explained.

Once the microcontroller receives information about where a piece of refuse is located, it moves the robot toward that location. When the robot finally reaches the garbage detected by the CNNs, it uses a robotic arm to collect it and drops it into a container (i.e. drawer) that is attached to its body.

"The design of the garbage collector can be split into three major parts: base, robotic arm and drawer," the researchers wrote. "The base drives the robot toward the garbage, the robotic arm collects the garbage and the drawer stores the garbage collected by the robotic arm."

The researchers have already developed a prototype of their waste detection system, which can currently collect up to 100-200g of [garbage](#). In their future work, they plan to expand on this prototype, so that it can collect two to three kilograms of rubbish before emptying its drawer.

In addition, the team is thinking of developing and training a new CNN model that would allow AGDC to detect multiple pieces of rubbish simultaneously. Eventually, connecting the robot to the internet could also enable wider-scale implementations, for instance, creating an automated network of systems that collaborate to efficiently collect waste in specific areas.

More information: Siddhant Bansal, et al. AGDC: Automatic garbage detection and collection. arXiv:1908.05849 [cs.RO]. arxiv.org/abs/1908.05849

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