

## Towards Smarter Waste Management with the Internet of Things

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With strained budgets and growing populations, the world is facing a crisis that keeps growing: what to do with the increasing generation of waste? How can municipalities handle the amount of solid waste that is expected to double from the current 2 billion tonnes per year by 2025? Do the cities need to double the amount of their collection vehicles and personnel to survive the crisis?



As we all know, traditionally waste collections are based on static routes and schedules within each city neighborhood: the residents are usually expecting a once-a-week collection, whereas the businesses typically have a more regular collection schedule depending on their industry. What is common for both is that the amount of waste is almost never static and the waste collection companies can only guess which bins are full or empty, causing unnecessary work and inefficient collection operations. Similarly, it is difficult for the waste companies to know if a bin is overflowing before the next dispatch, causing an unsightly and smelly problem in the neighborhood.

Although the waste generation keeps growing especially in developing nations, the situation is not completely hopeless. Thanks to the Internet of Things (IoT), many forward-looking waste management companies are now installing wirelessly connected sensors in their waste containers to enable reading fill-levels remotely in real time. As a result, the collection companies and municipalities are saving money on the collection costs while leaving a lighter ecological footprint and a cleaner environment.



## Sensors, trackers and a cloud platform

The concept of the IoT-based waste management is fairly simple: an ultrasonic fill-level sensor is installed in a container to send periodical data transmissions through 2G/3G or LPWAN to a remote cloud platform, where the data gets processed and optimization is made. The sensor works by emitting acoustic waves and then receiving back the echo. Upon reaching a level surface, the waves reflect back to the sensor with a reading - similar to a process of echolocation. Besides measuring fill-level information to detect a full trash can, the sensor can also measure the waste container's temperature, GPS coordinates, and angular orientation.

As for the software platform, its key feature is monitoring the containers' fill-levels historically and in real time, but nowadays it is also common to find a solution that allows predictive monitoring ahead of time. This allows an even more efficient route optimization as opposed to using only real-time data. Besides fill-level monitoring and route optimization, the features usually include waste collection history, overflow status, response times, fire events, push notifications, and error logs. The users can also receive actionable insight on collection performance and efficiency, waste generation, and overflow frequency to help them understand their operations and pinpoint areas that can be improved.

Some solution providers are now also providing an integrated fleet management solution where the hardware, software and customer's assets are all linked together. This enables the users to monitor vehicle statuses, control schedule dispatch times, track driver behavior and fuel consumption, and give drivers access to reporting tools for a comprehensive FM solution. Based on the data, the software platform can even provide customized improvement recommendations on the overall operations ranging from optimized bin placement location and distribution to collection schedules and fleet utilization.

### Increased efficiency and cleaner spaces

Detecting waste containers' fill-levels remotely by utilizing an IoT-based waste management solution enables waste management companies to increase their operational efficiency by up to 50%. The main driver behind the increased efficiency is the reduced amount of collection truck dispatches and waste collections, which subsequently results in smaller fuel, labor, and fleet management costs. Non-monetary benefits of utilizing the solution include smart data-driven decision-making, reduced CO2 emissions, less noise pollution, cleaner public spaces, and elimination of overflowing waste containers. Furthermore, reducing the waste overflow occurrences will decrease the health risks caused to the waste collection personnel during picking up and handling of the waste.

### Usable with all types of containers and tanks

The IoT-based waste management solution can be generally fitted with all types of waste containers and tanks to measure any type of waste, including solids and liquids. The bins with the highest potential for operational cost reduction include remotely located and far apart locations, bins with versatile filling patterns, and bins that hold high-value recyclables.

Because of the ability to monitor fill-levels, collections points can be tailored depending on the waste stream to avoid unpleasant smells during specific seasons, events and/or locations. Ideal applications can include but not limited to bins with difficult access, as well as large overground and underground containers, silos and tanks.

### Making the connected bin even smarter

Connecting the bins to the internet with smart fill-level sensors is only the beginning of the data-driven waste technology space. The chances are that you have already seen a futuristic looking waste container with a solar panel on the top, capable of not only measuring the fill-level but also compacting the waste and effectively increasing the bin capacity by up to 6-8 times. The container which used to fit only 100 liters of trash suddenly fits up to 800 liters, enabling even the busiest high foot traffic areas to decrease the amount of collections and eliminate overflowing waste bins. The solar energy is stored in rechargeable batteries, enabling the compactor to operate as a standalone system without any exterior wiring.

Solar-powered waste compactors commonly include a number of additional features, such as LED/LCD panels for generating an additional revenue stream through advertisements, a router that allows the bins to act as Wi-Fi hotspots, and various safety features such as fire and motion safety detectors. Most importantly, the bins reduce operational waste collection costs by up to 80%.

### The leading provider of smart waste technology

If you are interested in learning more about how IoT technology could improve your waste collection efficiency, and run a pilot project, please contact Ecube Labs. Our integrated waste management solution includes ultrasonic fill-level sensors, solar-powered waste compacting bins, integrated fleet management tracker, and a cloud platform that combines together waste container monitoring, data

analytics, and fill-level forecasting. Most recently, we have published a fleet management solution and LPWAN compatible fill-level sensors for LoRa and NB-IoT connectivity. Ecube Labs has offices in Seoul and Los Angeles. Its products and services are available through its distributors and can be seen in major metropolitan areas around the world.

