Literature survey on Smart Waste Management System For Metropolitan Cities

Problem statements :

In 2018, The World Bank pushed the emergency button by declaring that **global waste production** is expected to grow by 70 percent by 2050. If consumption and other activities generating waste maintain their rising trend, global waste production will increase to 3.40 billion tonnes in 25 years.

On the other hand, handling such large waste requires more than **citizen participation** or traditional solid waste management. Almost all solid **waste management** steps are mainly the responsibility of local governments and municipalities. So, what can improper management of solid waste lead to?

With the increase in waste production, the process of its collection becomes a crucial part of **waste management**. If we part the **waste collection operation**, the first step will be collecting the bins. So, how can we ease the operations and transform the traditional containers into **smart bins**?

All this bins in a city fills in different times and it is also not possible to maintain collection of waste in every bins in a shedualed manner. We have to get information about every **bin status** to do the job efficiently.

So, how can we provide such **information passing service** to maintain efficient works?

Government cleans every waste bin by workers assingned for that job. Every workers may not be able to use the **technology used for this system**. So, how do we provide such **interface easy** to every one who uses the platforms ?

Every after providing such interface , each and every data must be stored for future or current usages without any disturbances in the storage serivice. So, selecting perfect **server or cloud system** for **better service platform**.

Similar existing solutions :

GreenQ's Smart garbage truck :

GreenQ’s monitoring device, known as smart truck system, was installed and tested by the municipality of a city of 120,000 residents in Israel. An analysis of the data found 3 major recommendations of improvements with significant results. The results proved cost-effective, leading to a reduction in costs of over 50%, and the city to install the smart truck System on all their city trucks, with a monitoring station where the trucks and waste collected is tracked in real-time.

• Canceling one weekly collection day

• Diesel consumption (in liters): 8,000~. 53% costs reduction.

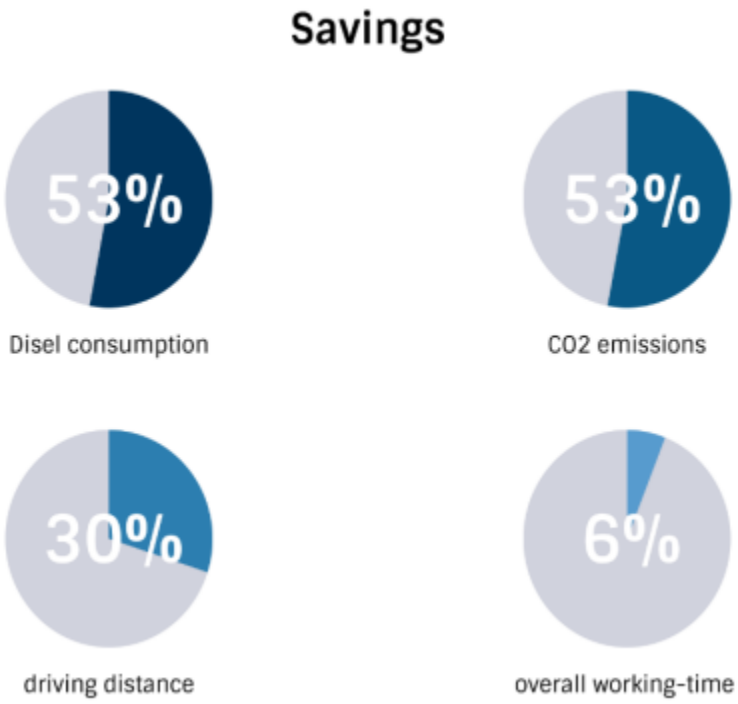
• CO2 emissions (in tons): 16~. 53% costs reduction.

• 6.3%~ of the current overall working-time.

How the Product Helped :

The smart truck System was implemented over the course of 35 days, and monitored by testing 1 truck out of 9 trucks in the city, and monitored the exact weight and volume of the bins during pick up to obtain data for how waste was collected. All data was monitored and recorded in real-time, and accessible from any device, either desktop, mobile or tablet.

The system also sent alerts via email and/or SMS, and allowed GreenQ and the municipality to track movement without having to wait for analytical results.



Results, ROI, and Future Plans :

The analysis of the smart truck System concluded and recommended reducing the trucks weekly pick up by a day while adding additional garbage bins in specific areas. The daily weighing procedure of the truck also deemed redundant and cost-inefficient, as it is already a tool incorporated in the System. In addition, data showed the need for trucks to stay closer to the city to cut down on emissions while on route. Adjustment from the recommendations would lead to a 53% reduction in costs of CO2 emissions, diesel consumption, and distance needed for driving. The return on investment for the municipality would be in less than a year, as well as overall reduced costs over the year.

Practical Challenges :

Before the deployment of Smartbins, a site survey was carried out. The objective of the site survey was to measure 2 the maximum distance and the quality of radio transmission between two

radios. The site survey was carried out by using two nodes: transmitter node and receiver node. A sensor node was used as the transmitter node. A laptop was used as the receiver node.

The receiver node stored received packets and calculated Packet Delivery Ratio (PDR) and Received Signal Strength Indication (RSSI). The wireless communication module attached to the sensor node was low power and low bandwidth (250 Kbps). With its limited bandwidth, a technique was applied to compress sensor information and, at the same time, data repetition was also included to increase data reliability.

The sensor node was deployed with battery power. Due to its limited power, a low power consumption sensor node was selected. The sensor node had limited memory size. This had an effect on the size of the program running on the sensor node. Thus a simple opportunistic routing protocol was chosen as the routing protocol.

Project outcome :

Garbage level detection in bins.
Getting the weight of the garbage in the bin.
Alerts the authorized person to empty the bin whenever the bins are full.
Garbage level of the bins can be monitored through a web App.
We can view the location of every bin in the web application by sending GPS location from the device.
Social impact : Clean and healthy environment, Better society
Buisness impact : Software as a serivice, Whole system as a service(including labors,technology,transport etc.,)

Results of existing solutions :

Overall waste collection cost reduction of at least 30% Sensoneo's software solution cost-efficiently manages the waste collection. Thanks to real-time monitoring, Smart Analytics and Smart Route Planning, cities are able to rely on data-driven decision-making to achieve a collection cost reduction of at least 30%, by optimizing the collection routes, pickup frequency and vehicle loads.

Improve the environment

Well-managed waste in the city with Sensoneo's smart waste management solution improves the environment. The real-time data monitoring, Smart Analytics, and Smart Route Planning ensure more efficient waste collection, resulting in fewer cars, less noise, less traffic, and a carbon emission reduction of up to 60% in cities and most of all – a litter-free city. Additionally, the sensors are equipped with replaceable batteries and are made from recyclable polyimide optical fibers that provide not only an eco-design, but also help with recycling.

Improve the well-being of people

Cities can improve the well-being of citizens with the smart waste management solution by Sensoneo.

The implementation of our solution helps to optimize the capacity of bins and to promote separation of recyclables by residents. With sufficient capacity, there is always enough space for people’s trash – general and separable. The need-driven waste collection eliminates unnecessary traffic blockage and overflowing bins. Cities, as a result, become cleaner and free of litter, trash and garbage and sustainable solutions like recycling are promoted.