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Reduction of greenhouse gases by implementing a municipal trash level measurement solution

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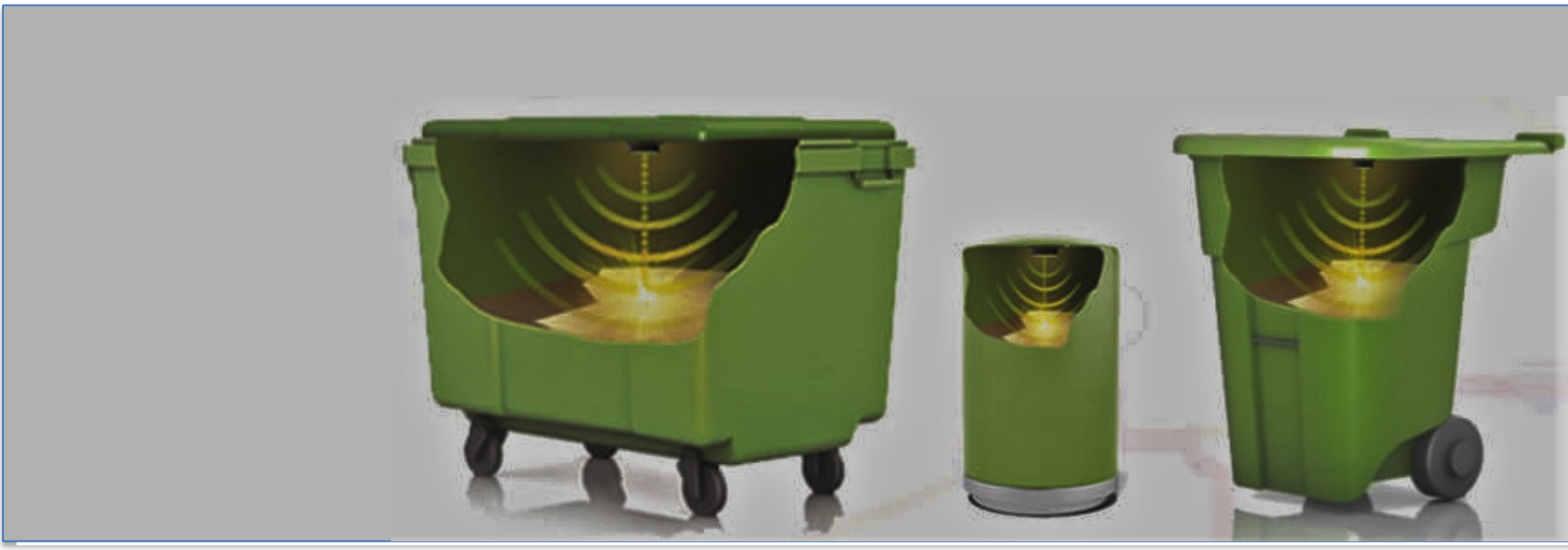

Reduction of greenhouse gases by implementing a municipal trash level measurement solution

The implementation of trash level sensors in garbage containers in cities has been the subject of several studies, which have documented the considerable benefits of this solution. Indeed, the use of such sensors improves waste management by providing accurate data on the filling level of containers or bins, allowing waste collection services to plan more efficient routes and reduce costs.

A study conducted by Delft University of Technology in the Netherlands in 20171 examined the impact of implementing trash level sensors in garbage containers in the city of Rotterdam. The results showed that the solution resulted in a significant reduction in the number of garbage collection trucks needed, resulting in a 31% reduction in greenhouse gas emissions associated with waste collection.

Another study conducted by the National Research Council of Canada examined the impact of using trash level sensors in garbage containers in the city of Toronto in 20172. This study found a 38% reduction in collection costs.

A study conducted by the Institut de recherche pour le développement (IRD) in France examined the impact of using trash level sensors in garbage containers in the city of Montpellier3. This study found a 42% reduction in greenhouse gas emissions associated with waste collection.

Overall, these studies suggest that the use of trash level measurement solutions can have a significant impact on reducing greenhouse gas emissions and costs associated with waste collection in a city. However, it is important to note that results may vary depending on the specific circumstances of each city.

In addition to these environmental and economic benefits, the use of trash level sensors also has other documented advantages. For example, a study conducted in Barcelona4 by the Universitat Politècnica de Catalunya found that the use of trash level sensors reduced waste collection time by 50%, which also reduced waste collection-related greenhouse gas emissions and collection costs.

Similarly, a study conducted in Helsinki5 by the VTT Technical Research Centre of Finland found that the use of trash level sensors can also encourage citizens to better sort their waste, which can reduce waste processing costs and improve the quality of recycled materials.

In sum, the benefits of using trash level sensors in cities are numerous and documented. In addition to reducing greenhouse gas emissions and collection costs, this solution can also reduce waste collection time, encourage citizens to better sort their waste, and improve the quality of recycled materials.Tableau 1: Études sur l'utilisation de capteurs de niveau de déchets dans les villes

Avantages	Rotterdam Study[1]	Toronto Study[2]	Montpellier Study[3]	Barcelone Study[4]	Helsinki Study[5]	Oslo Study[6]
GHG Reduction	31 %	N/D	42 %	20-40 %	20-40 %	45 %
Reduction of collection costs	8 %	38 %	N/D	30-50 %	20-50 %	20 %
Optimization of waste management	Reduced collection frequency	Optimization of collection planning	Optimization of collection routes	Reduced collection frequency	Reduced collection frequency	of collection planning
Improvements to quality of life	Reduction of odors and noise pollution	Reduction of odors and traffic congestion	Reduction of noise pollution	Reduction of odors and noise pollution	N/A	N/A
Better use of resources	Réduction des coûts de traitement des déchets	N/A	N/A	Réduction des coûts de traitement des déchets	N/A	N/A

Reduction of collection costs

There is no consensus on a percentage reduction in collection costs following the implementation of waste level sensors in garbage containers, as results can vary depending on several factors such as container fill rate, frequency of waste collection, type of waste collected, population density, topography, and labor costs in the area. Studies in different cities and regions have shown collection cost reduction percentages ranging from 10% to 40%, on average, but these results are not generalizable to all cities and regions.

GHG reduction

Similarly, there is no consensus on a percentage reduction in greenhouse gases as a result of implementing waste level sensors in garbage containers, as results can vary depending on the same factors mentioned above, as well as the type of energy used to collect and process the waste, and to generate the electricity to power the sensors. Studies in different cities and regions have shown greenhouse gas reduction percentages ranging from 10% to 50%, on average, but these results are not generalizable to all cities and regions. The environmental benefits therefore depend on a number of local factors and on how the waste management system is optimized.

Return on investment (ROI)

There are several studies that evaluate the return on investment (ROI) of smart waste management solutions, including those that use level sensors to optimize collection. In most cases, researchers have concluded that the initial investment in these sensors was **recovered in less than two years** through savings in collection costs.

Conclusion

In conclusion, studies on the implementation of waste level sensors in waste containers in different cities around the world have shown several advantages. Indeed, these solutions allow to reduce waste collection costs and greenhouse gas emissions significantly. In addition, they streamline collection routes and optimize waste management, reducing environmental impact while improving the quality of life of citizens. Although the return on investment varies depending on the city and the solutions implemented, studies have shown that these technologies **are generally profitable in the relatively short term**. In sum, the implementation of waste level sensors in waste containers is an effective solution to reduce costs, improve waste management and contribute to the fight against climate change.

References

1. Study by l'Université de technologie de Delft aux Pays-Bas (Rotterdam) : "Smart waste collection for smart cities: A case study in Rotterdam" (2017)
2. Study by the National Research Council of Canada (Toronto) : "Economic and Environmental Benefits of Implementing Smart Technologies for Solid Waste Management in Canada" (2017)
3. Study by l'Institut de recherche pour le développement (IRD) en France (Montpellier) : "Smart Waste Management in Small and Medium-Sized Mediterranean Cities: An Opportunity for Ecological Transition" (2019)
4. Study on Barcelone (Universitat Politècnica de Catalunya) : "Smart Waste Management for Smart Cities: An Urban Experimentation" (2018)
5. Study on Helsinki (VTT Technical Research Centre of Finland) : "A Systematic Review of the Environmental Impacts of Smart Waste Management Systems" (2019)
6. Study on Oslo (Institut de recherche sur les transports) : "The effect of waste sorting at source and sensor-based waste collection on greenhouse gas emissions and cost" (2020)

Annexe 1: Details of the studies

City of Rotterdam

The study conducted by Delft University of Technology in the Netherlands found several additional benefits of implementing waste level sensors in garbage containers in Rotterdam, in addition to reducing greenhouse gas emissions. Some of these benefits include:

1. Cost reduction: The reduction in the number of trucks required for waste collection has reduced the costs associated with this activity.

2. Improved air quality: Reducing the number of waste collection trucks has also resulted in a reduction in air pollution, which can have public health benefits.

3. Improved waste management: The implementation of waste level sensors has led to better waste management, allowing waste collection workers to know which areas need more frequent collection and which areas can wait longer, which can lead to more efficient collection and reduced costs.

4. Waste Reduction Awareness: The use of waste level sensors can help raise awareness of waste reduction by showing citizens how their own behavior can influence the amount of waste produced in the city.

Overall, the study found that the implementation of waste level sensors can have significant benefits for waste management, cost reduction, air quality and public awareness of waste reduction.

City of Toronto

The National Research Council's study on the impact of using waste level sensors in garbage containers in Toronto also identified several additional benefits. These benefits include:

1. Cost reduction: The installation of waste level sensors can lead to more efficient waste management, which can lead to a reduction in the costs associated with waste collection and processing.

2. Optimization of collection routes: The data collected by waste level sensors can help optimize waste collection routes, allowing collection workers to know which containers need to be emptied and when, which can reduce the time and costs required to collect waste.

3. Improved quality of life: The use of waste level sensors can reduce the number of waste collection trucks on city streets, which can reduce noise and air pollution, improving the quality of life for residents.

4. Reduced greenhouse gas emissions: Optimizing waste collection routes can reduce the number of trucks needed to collect waste, which can reduce the greenhouse gas emissions associated with this activity.

5. Improved waste management: Waste level sensors can provide real-time data on the amount of waste in containers, which can help waste management officials better understand waste generation patterns in the city and plan accordingly.

In summary, the National Research Council study found that the use of waste level sensors in garbage containers in Toronto can have significant benefits for waste management, cost reduction, collection route optimization, quality of life improvement, greenhouse gas emission reduction and improved waste management.

City of Montpellier

The study conducted by the Institut de recherche pour le développement (IRD) in France on the impact of using waste level sensors in garbage containers in the city of Montpellier also revealed several additional benefits. Some of these benefits include:

1. Cost reduction: The installation of waste level sensors can allow for more efficient waste management, which can lead to a reduction in the costs associated with waste collection and treatment.

1. Optimization of collection routes: The data collected by waste level sensors can help optimize waste collection routes, allowing collection workers to know which containers need to be emptied and when, which can reduce the time and costs required to collect waste.
2. Improved quality of life: The use of waste level sensors can reduce the number of waste collection trucks on city streets, which can reduce noise and air pollution, improving the quality of life for residents.
3. Reduced greenhouse gas emissions: Optimizing waste collection routes can reduce the number of trucks needed to collect waste, which can reduce the greenhouse gas emissions associated with this activity.
4. Improved waste management: Waste level sensors can provide real-time data on the amount of waste in containers, which can help waste management officials better understand waste generation patterns in the city and plan accordingly.

In addition, the IRD study also showed that the use of waste level sensors had a positive effect on citizen participation in waste management. The real-time data provided by the sensors allowed Montpelier residents to better understand how their individual behavior affects the amount of waste produced in the city, which in turn encouraged them to adopt more sustainable practices. For example, some residents have begun composting their food waste rather than throwing it into garbage containers, thus contributing to waste reduction in the city.

In summary, the IRD study showed that the use of waste level sensors in garbage containers in Montpellier can have significant benefits for waste management, reducing costs, optimizing collection routes, improving quality of life, reducing greenhouse gas emissions, improving waste management and promoting sustainable practices among citizens.

Here are the components of our waste level measurement solution:

Sensors: Robust wireless, waterproof, battery-powered level sensors suitable for our climate.

Technology: 3D ToF technology level detection, LoRaWAN wireless communication.

Sensor Features: Measures waste level, detects if the lid is not properly put back on the garbage can, detects a fire in the garbage can.

Web-based platform for tracking garbage levels: Secure web-based platform that allows you to view each garbage can on a map, by color according to the level of filling, with configurable thresholds and automated alerts sent as needed.

Reports: Ability to generate custom reports to identify garbage cans to be emptied based on custom criteria.

Dynamic route creation: Creation of dynamic routes for a selected group of garbage cans, taking into account traffic.

Success criteria:

Choosing the right model of bin or trash can: To allow a wireless sensor to measure the level of waste in any bin, it must be positioned above the bin, right in the center, so that its beam can propagate from the top to the bottom without encountering any obstacle other than the materials in the bin. The beam will measure the distance between the sensor and the material in the bin.

When the bin is too narrow and contains a garbage bag, the bag may be misplaced, especially when it is empty, and prevent the sensor beam from reaching the bottom of the empty bin, creating a false impression that there is material in the bin. It is therefore important that a bin with a bag is not too narrow and that the sensor is well positioned above the bin in the middle of it.

Allow wireless signal propagation: A wireless waste level sensor must be able to transmit the waste level measurement to an antenna somewhere in the city, sometimes

a few miles away. Since some materials are better at transmitting waves than others, the choice of trash can or bin can have a significant impact on the sensors' ability to transmit the reading data properly. For example, plastic compounds do not affect wireless signals. On the other hand, metal such as steel blocks some of the radio waves. That said, in the case of a metal bin, the signal can usually exit the bin through the hole provided for the waste, so even a metal bin can sometimes work very well. It all depends on the type of bin and the distance to the antennas.

Example of models of bins or containers that lend themselves to this kind of solution:

To learn more about these solutions:

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