Team Name: Team Sattva

Team Members: Aaditya Jha, Aalok Aryal, Aditya Krishna, Elina Kattel

Project's Name: Smart Bins for Effective Segregation and Collection of Solid Waste

Problem Statement

The Kathmandu Valley generates around 1200 metric tons of solid waste daily. Kathmandu Metropolitan City (KMC) alone accounts for almost 50 percent of the total waste generated in the valley. Owing to high population density, soaring consumption, and poor waste management, the number is predicted to rise exponentially if timely remedial actions are not taken. According to the Central Bureau of Statistics, organic waste is believed to make up nearly 65 percent while recyclable waste accounts for 15-20 percent of the total municipal solid waste in Kathmandu. This suggests that KMC should be dumping only 20 percent of solid waste in landfill sites.

However, dumping of the entire waste has been a major problem when it comes to the question of the sustainability of landfill sites. This failure to emphasize on segregation of solid waste during collection was one of the major reasons behind the abysmal condition of Sisdole.

With the delayed construction of the landfill site and its incomplete facilities, inefficient collection of solid waste, and irregular disposal combined with the unsustainable nature of landfills, the issue of solid management poses a genuine concern.

The waste produced daily can be categorized mainly as bio-degradable and non-biodegradable. Similarly, non-biodegradable waste can be categorized into glass, plastic, metal, and chemical waste while biodegradable waste is categorized as paper waste, organic waste, and wood-furniture waste.

If segregated and disposed of according to their nature, these solid wastes are not less than precious resources. However, the entire solid waste of Kathmandu valley, without being segregated, is disposed of directly in Banchare dada. This hill is said to last Kathmandu valley for 50 more years but! What about after that? Where will the solid waste of Kathmandu valley be disposed of? What about the people living in the vicinity of the Banchare dada? What about our future generation who will have nothing but this city completely ruined by our short-sightedness?

Garbage Transfer Station of Kathmandu Metropolitan City
Picture source: self

Proposed Solution

The matter of solid waste management has been a burning issue for decades, yet, not only are we unable to eradicate it, the problem becomes worse by the day.

Kathmandu's waste management problem is a legacy left by those who were in power earlier and did nothing close to finding a long-term solution. The Solid Waste Management Act 2011 finds the local bodies responsible for waste management. Thus, it is clear that KMC officials need a radical way to find a lasting solution to this menacing problem that has frequently plagued city dwellers.

As such, after a thorough study of the challenges in waste management and the measures taken by the metropolis in the past, the segregation of waste at the source has been noted as the most basic yet the most important solution to this issue.

In this digitalized era, we are blessed with smart technological expertise. Then why don't we use it to help solve this issue of solid waste management in Kathmandu valley?

This proposal suggests the use of smart bins to facilitate proper segregation of waste. It has the same work as traditional dustbins but as a bonus, the dustbins are equipped with sensors that can recognize the type of waste before the lid slides open. Two bins would be stationed at different points in the city, one each for biodegradable and non-biodegradable waste. With the help of the sensors, we collect data from the garbage bins, send them to a gateway using the Wi-Fi system of the dustbin, and to the cloud over the Internet.

In our proposition, such bins are placed at various locations in the entire city. Then, the real-time status of the garbage level and the location of the bin is sent to the authority responsible for the waste collection. The waste collection drivers would have an app specifically designed for this purpose on their mobile phones, allowing them to efficiently collect the garbage from the bin using the shortest route.

Picture Source: IoT Central

Project Implementation

Once the idea gets the green signal, the metropolitan delegates the responsibility of maintenance and proper functioning of the bins to the respective wards. Each ward may maintain a number of smart bin stations that is felt necessary to collect the waste from the residents. The ultimate beneficiaries of the effort, the people living in the Kathmandu valley, need to be made aware of the working of the system in place.

Smart bins are slightly different from traditional bins as they are a bit more expensive. Hence, a proper budget must be allocated in a transparent environment. Investing in the future of our city is a totally worthy cause.

The development of the mobile application to give real-time data on the garbage bins should also go simultaneously. The waste collection drivers should also be distributed all over the valley according to the need.

Suitable manpower should be recognized and deployed accordingly.

Tools Required to Build the Smart Bin

The proposed smart bin requires the following tools:

1. Infrared sensors: To monitor the surroundings around the garbage bin to avoid waste disposal outside the container. If garbage is disposed of improperly, the infrared sensor detects the garbage around the waste bin. Then, it triggers alarms that notify people to dispose of the waste properly.
2. Fill-level sensors: To sense the level of trash bins to determine if it needs to vacate.
3. Trash Compactor: When the garbage inside the bin reaches the pre-defined level, the trash compactor activates and compacts the garbage to reduce the volume of plastic and paper so as to maximize the storage capacity.
4. A simple mobile application: To access the data from the bins and send alerts for timely collection.

Implementation Model

Recently, our team went on a field visit to Garbage Transfer Station, Teku, to learn more about how the garbage is being taken care of in Kathmandu Metropolitan City. Visiting the site in person was an eye opener to the efforts and issues we have been overlooking.

Talking to one of the workers at the transfer station, we got to learn more about the treatment of waste.

There are enough waste collection trucks and manpower in the metropolis. Our project also plans for the maximum utilization of available resources, such as vehicles and drivers. If given a proper working environment and wages, with the cooperation and coordination of local bodies and government, the plan is feasible under the present working capacity.

As early as Shrawan 2079 BS, the metropolis has been trying to implement the rule of segregation of waste from the home itself, but to no avail. Hence, the

use of smart bins would assist the officials of the valley in solid waste collection and management.

Smart bins are a bit costly and consume electricity for functioning. Along with proper budget allocation from the government, we plan to devise the most effective and cost-efficient way to implement this plan. This would include the discussion on the use of alternative sources of energy such as solar cells to power the bins.

An informative visit to KMC Garbage Transfer Centre

Solution Viability and Scalability

The proposed idea helps in solid waste management in the following ways:

With separate bins that are equipped with sensors, the segregation of waste will be effective. The biodegradable waste can be taken separately to the compost site to turn into manure while the non-biodegradable wastes can be sent for recycling according to their nature.

The bin can auto-deodorize and sterilize regularly to keep off foul odor and check bacterial growth inside it, thus eliminating any secondary effects of the waste.

The mobile app that gives notifications about the data on garbage bins will also help in the timely collection of garbage in the valley.

When these bins are deployed in enough numbers, the need to collect waste door-to-door would be eradicated. This is also expected to promote segregation of waste at the source into degradable and non-biodegradable waste.

Practical Approach and Alignment with this year's Call to Action

The ideathon aims to find sustainable solutions to the plights of Kathmandu valley. The management of solid waste has been a long-standing problem in the Kathmandu valley. While many plans have been brought forward, not many have seen the light of day. The implementation of the proposed idea would facilitate segregation and collection of waste, the initial stages in the process of solid waste management. The solution to a problem only bears fruition if it targets the root cause. The smart bin is an attempt to contribute to the metropolitan's attempts to effectively manage solid waste by directly being in contact with the general public. We firmly believe that the enactment of our proposal will instill a habit among the people in the valley to separate

the waste at their homes and dispose of those wastes accordingly. Hence, the use of smart bins saves the resources that would have otherwise been used in separating the waste after its collection. Although it is not a panacea, we hold the opinion that the implementation of smart bins sets the foundation for further processes in the management of solid waste.

Smart Bins and Sustainable Development Goals:

SDG 6: Clean Water and Sanitation

Water Pollution is the result of improper solid waste disposal. But, with smart bins available everywhere, disposal of garbage in water sources will slowly but surely decrease.

SDG 7: Affordable and Clean Energy

A continuous supply of power is needed for the working of the smart bin. Solar cells would be used to generate the power and keep the bins running.

SDG 11: Sustainable Cities and Communities

If the current trend continues, Kathmandu Valley will turn inhabitable in the foreseeable future. But with the proper segregation of garbage and its treatment, the environmental impacts of solid waste can be largely minimized, hence, transforming the city into a beautiful smart city.

Scalability

Our approach to solving the problem of solid waste management is not only effective in the long term but also flexible. The mobile application for waste collection can be designed and updated according to necessity. Even the manufacturing cost of the smart bins can be greatly compensated by recycling and modifying the already existing bins. The bins can be placed in various parts of the cities by taking into account the population density, waste generated, etc.

Initially, the proposed smart bin will be thoroughly tested before implementing at a community scale in Kathmandu valley. This pilot test will allow gaining further insights on areas of improvement and then only be operated. And by taking into consideration the infrastructural and technological differences, we will extend our operation to different cities and towns in our country.

Conclusion

The implementation of this plan will take time and so will the results to be seen. But if we do not start now, then when? It is high time we take a solid step towards this problem of solid waste management in Kathmandu Valley to erase the tragedy that plagues us- the destruction and ruin that awaits us!