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Prototype Model for Waste Management in Running Trains ofIndia

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ABSTRACT
Indian Railways is the largest public sector undertaking in India but suffers from a major problem of inefficient waste management system. This is a problem of dry and wet waste generated inside the running train and around the railway tracks resulting in unhygienic trains and unclean railway tracks. Everyday nearly 23 million people travel in 7000 passengers trains inIndia. The area around the railway track in India is about 16000 kms which has never been cleaned. It is estimated that approximately 6289 tons of plastic finds its way into India's railway tracks every day. This enormous generation of waste is leading to undesirable health issues besides environmental pollution. In this backdrop, in this project a prototype technological modelis being developed which can help to solve this problem. A smart dustbin is placed in each compartment of all the bogies in a train wherein both the dry and wet waste are collected, segregated and crushed. With the help of the belt conveyor, this crushed dry and wet waste is carried from all the compartments and bogies to the centralized bin of the train. This technological prototype model facilitates to manage the enormous dry and wet waste generated inside the running train effectively and efficiently. This will benefit the recycling industries to generate the revenue besides helping to keep the trains and railway tracks clean.
Keywords— Dry and Wet waste, Smart Dustbin, Indian Railways, Running Train and Waste Management.

INTRODUCTION:

Indian Railways is the fourth largest railway system in the world and the biggest public sector undertaking in India. The Ministry of Railways manages the Indian Railway system and it is one of the major public facilities provided by the Central Government to the citizens of India. Everyday thousands of people travel in the passenger trains to the different destinations as the railway network is well connected throughout the length and breadth of the country. However, Indian Railway system is not without problems. But the most significant and formidable problem is that of waste management in trains. At present, Indian Railways comprises of 11,500 kms (71,000 miles) of track covering a route of 65,808 kms (40,891 miles) spread over 7,112 railway stations [1]. In the fiscal year ending March 2018, Indian Railways carried 8.26 billion passengers and transported 1.16 billion tons of freight [2]. Generally what the passengers do while traveling in the trains is, they purchase the drinking water bottles, snacks like chips packets, tea/coffee cups, cold drinks, plastic plates, etc. After consuming the eatery, they throw the remains and leftovers out of the movingtrain through the windowpane. Even if they don't cast it out, it is very common to observe thatthe same is thrown in the train itself. Later the sweeper while cleaning the train throws it outor puts in the dustbin. However most of the time, both the dry and wet waste generated in the running train is thrown out on the tracks. The area around the track in India is approximately 16,000 kms and this has never been cleaned [1]. According to a Report in 2009, by the Controller and Auditor General, everyday about 6,289 tons of plastic waste finds its way on to the Indian Railway tracks [3]. Day by day this problem is becoming deeper and severe. So far, this aspect has not been provided enough attention which it actually deserves. In this context we are introducing smart waste management system which can help to reduce such problems. It is practically an automatic system that collects all the dry and wet waste at one

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place in a modified form which can be handed over to the municipal authorities for further needful action. This prototype technological model of waste management system can also be a source of revenue generation .

REVIEW OF LITERATURE:

There are several studies, which are conducted on Indian Railway System with regard to the origin andgrowth, problems, merits and demerits, etc. but there are very few studies which focus on the waste management system in Indian Railways. According to Indian Railways (2015) around 23 million people travel by Indian Railways per day resulting in an enormousamount of solid waste generation which is nearly 670 tons per day (TPD) [2]. Out of this, major contribution is of plastic waste.Sharma, et al (2016) in their paper, estimate the plastic waste generated in Indian Railways is roughly 340 tons per day (TPD) [4]. Even though significant amount of waste is generated daily through the running trains, but the reliable data is hardly available on this issue. Appropriate facilities are scantily provided in most of the trains and several of the dustbins which are placed inside the trains are not covered by the polybags properly. In most of the cases the capacity of such dustbins is very less as compared to the volume of the waste generated by the passengers. More often than not, the shortage of the manpower to handle the dustbins also aggravates the severity of this problem. In this context, Srivastava, et al (2016) in their paper discuss about the placement of smart dustbin below the washbasin at the end of each railway bogie. He develops a modelwherein all the smart dustbins in every bogie are connectedthrough a belt conveyor and the waste is transferred on to the centralized dustbin [1]. The major space/gap in their model is that, the solid waste is not segregated and the smart dustbin is placed at the end of each bogie below the washbasin but not in each compartment. Further it is not economically viable because the manpower is needed to segregate the waste. Gawande, 2018 explains about the random survey of four express trains conducted by the researchers of IIM, Ahmadabad at the Surat railway station, Gujarat to get an idea of the nature and amount ofsolid waste generated pertrain per day. He concludes that, there is lack of modern and mechanized approach towards waste management in trains and it seems there is no proper planning in this regard [5]. As it is evident from the above brief review of literature, there is a need for developing a model to manage the dry and wet waste generated in the running trains in an efficient and effective manner.

OBJECTIVE OF PROJECT:

The broad objective of this project is to develop a technological prototype model of smart dustbin specifically inrunning trains of India wherein a smart dustbin is placed in each compartment of all the bogies in a train. This may help to tackle the problem of waste generated in a running train and the waste scattered along the tracks since severalyears .This mechanism is a step towards not only economizing the labour cost of sweepers/scavengers but also towards maintaining cleaner trains in line with Swatch Bharat Abhiyan. Further vendors purchase all types of wastesas that can be used for recycling hence this prototype model developed here may help to generate revenue also.

CONSTRUCTION AND WORKING PRINCIPLE:

The construction flow is as follows. At present in Indian Railwaya small adjustable wooden plank is provided in between the two windows/births in each compartment to help the passengers to keep their belongings. In our project, below the above mentionedwooden plank, a smart dustbin with two openings, one for dry and another for wet waste,is fixed. The opening and closing of these two parts of the dustbin will is done through manually operated sliding plates. This dustbin is of the size 30 inches in height and 15 inches in width with two openings of different size i.e. 12inches and 6 inches respectively. A motor driven metallic crushers are fixed beneath both the openings separately, just about 10 inches above the base of the dustbin to crush the dry and wet waste. At the base of the dustbin, two openings are provided for crushed dry and wet waste to pass on to the belt conveyor with a

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separator to accommodate the dry and wet waste separately. Likewise, all the compartments in all the bogies of a train are connected through a common belt conveyor carrying both dry and wet waste separately to the centralized dry and wet bins. The speed of the conveyor may be adjusted between 50 to 65 FPM (feet per minute). The solar and wind energy can be used to generate the electrical power needed by this system or even the train can also generate the needed electricity by itself. This is completely a concealed system. The work process of the model isas follows. As the volume of the waste increases in the dustbin and as soon as the weight of the waste surpasses the weight limit of 100 gms for dry waste and 250 gms for wet waste, an automatic sensor driven crusher will start rotating for 3 mins. Asa result of this, all the dry waste gets crushed into tiny granules and wet waste into semi-solid form. Further both these crushed materials get dropped on to the conveyor separately through their respective openings at the base of dustbin. Similarly, both the dryand wet waste from each compartment of all the bogies of a train is collected and carried to the centralized bins. The centralized bins shall be emptied and washed periodically with a disinfectant.Thevendors nominated by the designated department at the platforms will collect this modified form of both dry and wet waste for the purpose of recycling [6].

Figure.2. Location of Smart Dustbin in a . Railway Bogie.

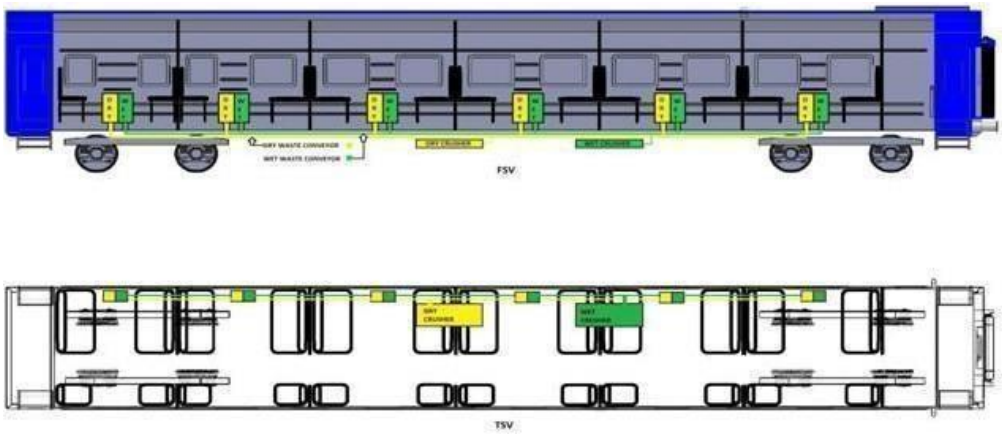

Figure.3. Location of Smart Dustbin in a Railway Compartment

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- first one is dry weight conveyer
- second one is wet waste conveyer

Figure 1 shows the sequential steps in the working of the model. Theconstruction and placement of smart dustbin with conveyor system is displayed in figure 2 and 3.

Advantages:

- Ensures efficient comprehensive waste collectionmechanism in running trains
- Stops unhygienic practice of throwing dry and wet waste through the windowpane inrunning train.
- Helps to keep the railway track and its surrounding clean.
- Economizing the labour cost of cleaning within the train and also the surroundings ofrailway track.
- Revenue generation through waste recycling.
- Helps to reduce the health hazards of the passengersand also the railway staff.

CONCLUSION

At present the problem of waste generated inside the running train and around the railway tracks is a burning health and environmental issue which calls for immediate attention of the policy makers. As of now the waste generated from the running train is lacking proper collection, segregation and disposal mechanism. Hence, proper management of so generated waste requires the construction and installation of essential facilities based on a suitable management program. In this study, an effort has been made to develop a prototype model for waste management system which can effectively and efficiently manage the enormous dry and wet waste generated inside arunning train. This will benefit the recycling industries to generate the revenue besides keeping the trains and railway tracks clean. This project is expected to help the concerned authorities to take corrective measures and ensure efficient waste management process which would help in making the Indian Railways cleaner and greener.

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