



CHUTE BASED AUTOMATIC WASTE SEGREGATION USING ARDUINO

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Abstract: The proposed idea is an innovative and unique way, which can solve the major problem of waste segregation and prevent the waste from overflowing from the dustbin on the streets which is a huge problem in India as well as in other parts of the world. It can also help in reducing the amount of recycled waste that is dumped into the dumping grounds by effectively segregating the recyclable waste. The solution provided to solve all the above-mentioned problems is "Automation of waste segregation". It provides a way in which the waste is segregated at the time of collection i.e. at the source itself. To do so an inlet will be provided in every apartment of the building through chutes to collect waste, and at the same time segregate the waste into wet and dry at the source itself. The system is implemented using Arduino and various sensors which serves to be the most cost effective and accurate way.

Index Terms - Waste segregation · chutes · wet waste · Dry waste

I. INTRODUCTION

Can you think of what happens to the waste that is collected from our homes and offices? The current waste management practice in India involves collecting waste from sources through a community collective bin system, after which it gets transported to a low-lying landfill system only 30% of which is hand-picked manually by workers from these landfills. These workers are at a high prevalence of disease among waste pickers due to their exposure to hazardous materials such as paper saturated by toxic materials, bottles and containers with chemical residues, contaminated needles and heavy metals from batteries.^[1]

The remaining waste stays in the dumping ground and causes harmful environmental problems as well as causes problems to the people living in the vicinity. The problems caused short-term and long-term health issues. Short term include asthma, congenital illnesses, stress and anxiety, headaches, dizziness, nausea and respiratory infections. Long term concerns include cancer and kidney, liver, respiratory, cardiovascular, brain, nervous, and other diseases.

The only solution to all the above-mentioned problems is proper waste segregation at the source itself so that majority of the waste can be recycled or decomposed effectively and only a minimum amount of waste is sent to the dumping ground. But due to lack of knowledge amongst the people about waste segregation as well as uncooperative behaviour of the people in the society the segregation is not carried out effectively. So the only way to solve the problem of waste segregation can be solved by using automation that is by automating the process of waste segregation. To obtain wet and dry waste at the source itself so it can be easily sent for recycling.

II. RELATED WORK

The segregation system implemented till now includes a sensor on the dustbin which opens the door of the smart bin automatically when a person comes to close proximity and the type of waste is detected based on the change in capacitance when the waste enters the bin.^[5]

Segregation is done using a conveyor belt. Waste is pushed onto conveyor belt, the presence of waste is first identified by use of Infra-red sensor at start end of the conveyor belt, the waste moves further for detection with inductive sensor to detect if it is wet or dry.^[6]

As well as in some cases the dustbin is partitioned and it rotates at an angle depending upon type of waste.^[3] Various methods used for detection of waste and an array of capacitive sensors are used to detect waste.^[4] Even combination of ultrasonic, and inductive sensor is used for detection of waste.^[2] The chute system which are implemented till now are only used for collecting the waste at the bottom of the building.

III. METHODOLOGY

The segregation system will consist of a chute-based system that will collect waste. The chute will have an inlet through which the waste will be collected and two different outlets through which the segregated waste will be obtained. This system can be installed in the building in parallel to the sewage pipes and the inlet can be provided in every apartment or flat of the building.

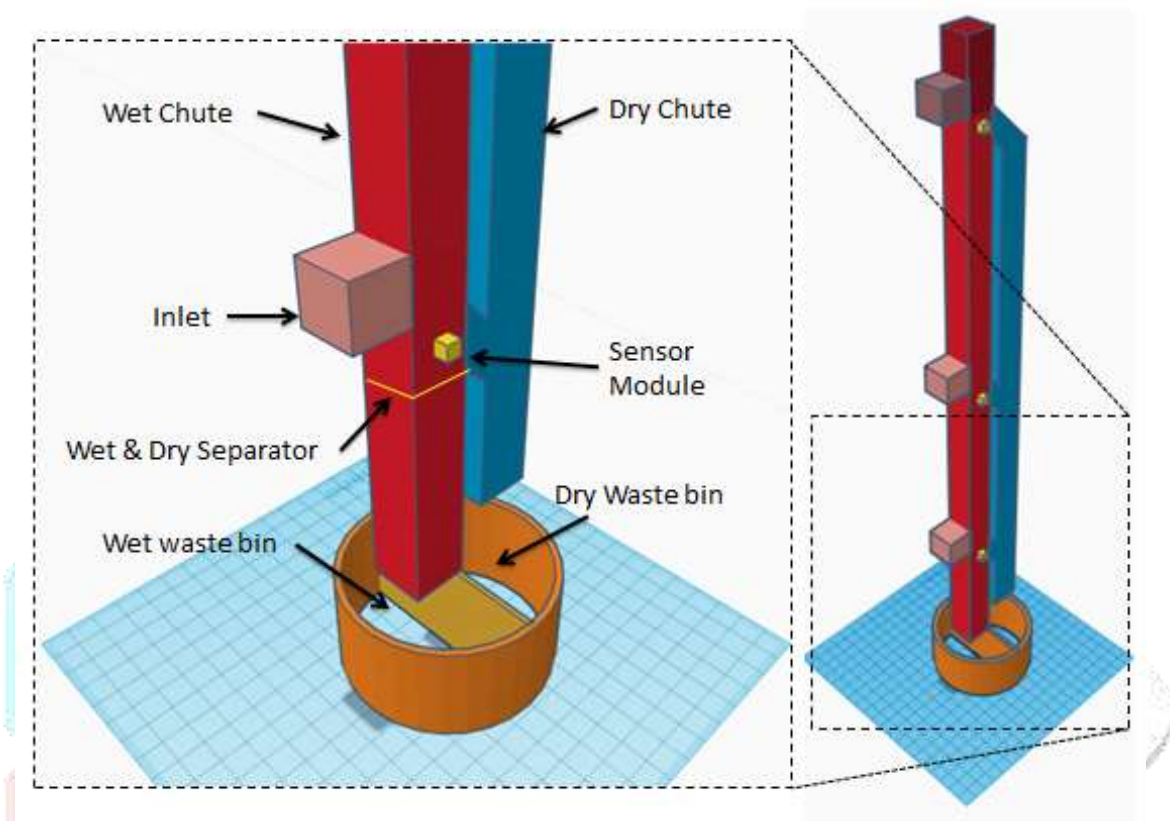


fig 1. 3D model of chute based waste segregation system.

As shown in the fig1 there are two different chutes for waste i.e. one chute for wet and the other for dry waste which starts from the top of the building to the ground. Each room on a floor has an inlet to these chutes. Just after the inlet, there is a sensor module that consists of an Ultrasonic sensor that detects when the waste comes into the inlet. Once it is detected it is pushed into the duct with the help of a flapper. Then in the chute it-self the type of waste is detected by the moisture sensor and separated by the flapper so that it can fall in their respective dustbins. This process is repeated at each and every floor of the building. Water sprinklers can be installed at the top of both the ducts to clean them and maintain hygiene.

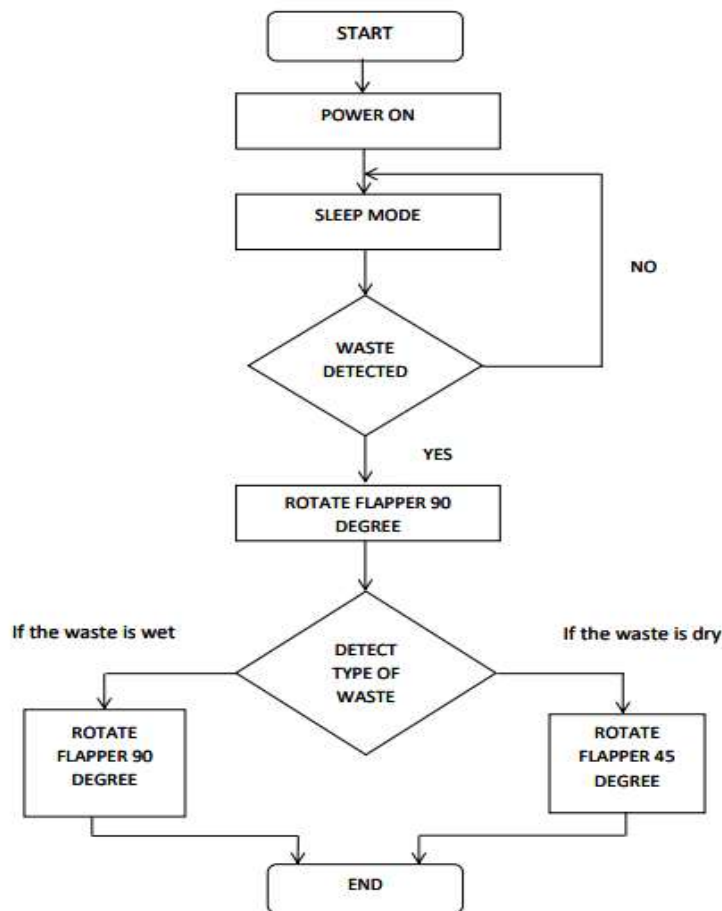


fig 2.flowchart of the waste segregation system.

As shown in the above fig 2, the system will be in the sleep mode unless and until someone throws waste into the inlet. Once someone throws waste into the inlet the system will be turned ON. The flapper will rotate 90 degrees to push the waste into the ducts. Then the detection of waste will take place i.e. if the waste is wet then the flapper will rotate 90 degrees, and if the waste is dry then the flapper will rotate 45 degrees. By this rotation of the flapper, the waste will enter their respective chutes and eventually fall in the dustbin.

IV. RESULT

After testing the moisture level for various materials, the results were as shown below in table 1.

table 1: moisture level of various waste products

Waste elements	Moisture level (%)
Broccoli	91
Oranges	87
Apples	84
Chicken (raw)	69
Bread	36
Paper	6
Cardboard	5
Plastic	3
Textile	10
Rubber	3
Lather	10
Wood	20
Glass	2
Tin cans	4
Aluminium	2
Other metals	4

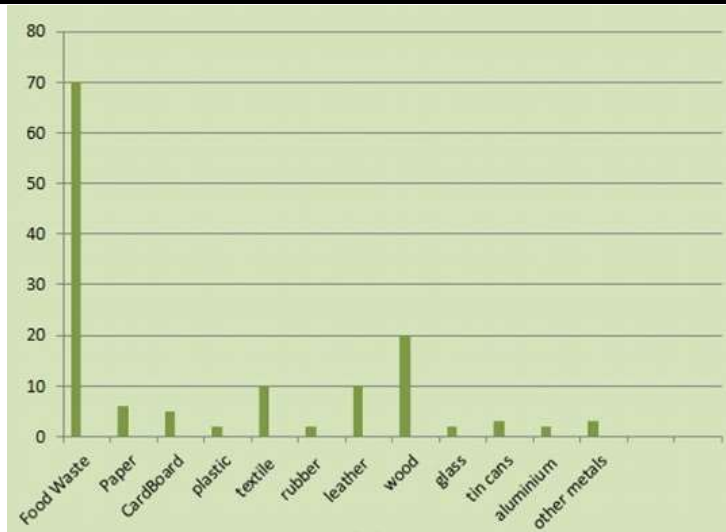


fig3 moisture level of various waste elements

As we can see, the wet waste that is mainly food waste has a level of moisture of up to 70%, while the other waste that is dry waste has a level of moisture below or equal to 20%.

And the threshold was set at 30%, which is known as dry waste and above 30% will be considered as wet waste.

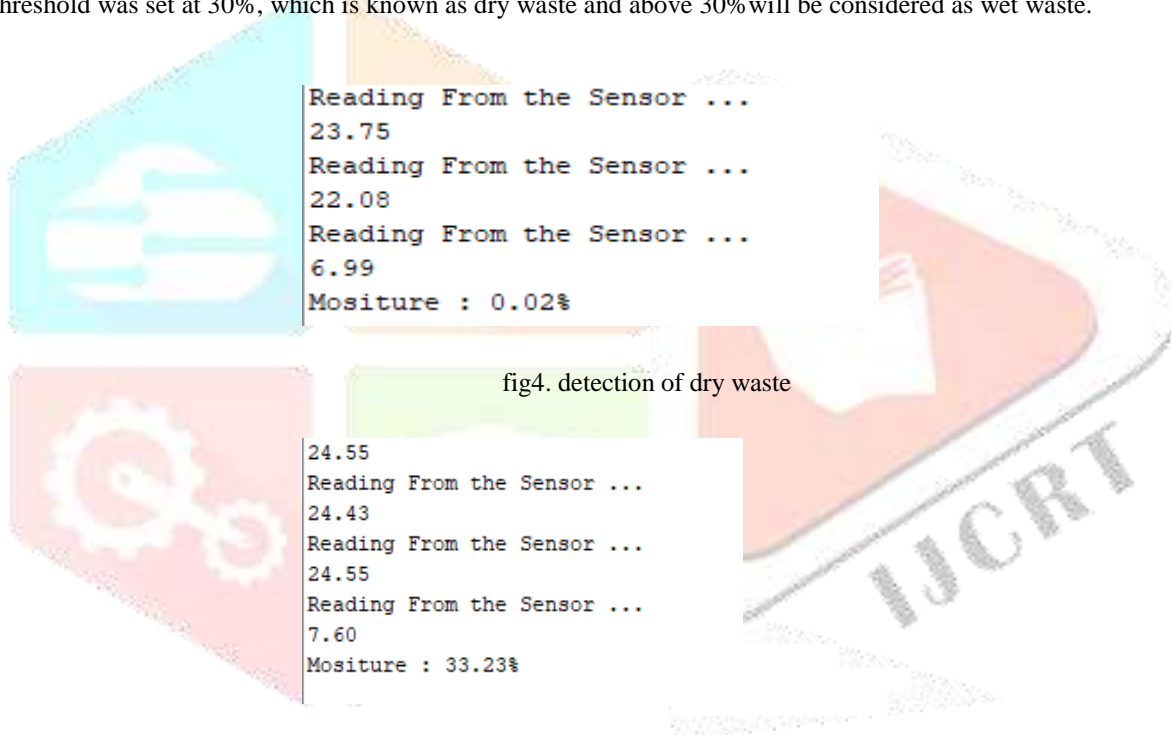


fig4. detection of dry waste

fig5. detection of wet waste

The ultrasonic sensor is used to detect the presence of waste so the reading from the sensor is the distance from the inlet till the sensor. If waste is present within 10cm from the inlet it will be detected and the moisture sensor will be activated. So as you can see in Fig 4 as soon as the distance becomes less then 10 cm as it is 6.99 cm in this case, the moisture sensor is activated and the moister is 0.02% that is dry waste and the flapper will move 45°.

Fig 5. shows the detection of wet waste that is as the distance is less then 10 cm. moisture is detected as moisture is greater then 30% it is detected as wet waste and the flapper rotates to -90°.

V. CONCLUSION

Automatic waste segregation as the name suggest, segregates the waste into wet and dry at the source itself. This is a chute or duct-based system which as the intel in every room of the building. As the waste enters the duct it is pushed on the moister sensor.

Depending upon the moisture level of the waste, it is separated with the help of a flapper which is controlled by arduino rotates and throws the waste into its respective dustbin. The angle of rotation depends on the moisture level.

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