Smart Bin

Anjitha Priyan J , Aparna Mohan S , Ashna Jose, Nandana S Nair

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENIGINEERING MAR

BASELIOS COLLEGE OF ENGINEERING AND TECHNOLOGY

S8 BTECH STUDENTS, A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Mar Ivanios Vidyanagar, Nalanchira, Thiruvananthapuram,695015

Abstract **--One of the main concerns with our environment has been solid waste management which has adverse effect on health of the society. Effective waste management is one of the major problems of the present era. The segregation, handling, transportation and disposal of waste are to be properly managed so as to minimize the risk to the environment. The economical value of waste is best realized when it is segregated. The traditional way of manually segregating the waste utilizes more human effort, time and cost. This project proposes a Smart Bin, an Economic Automated Waste Segregator (AWS) which is cheap and easy to use solution for a segregation system at households, so that it can be sent directly for processing. It is designed to sort the refuse into metallic waste, wet waste and dry waste with a food recycling unit. AWS using Arduino MEGA is implemented using an Ultrasonic Distance Measure Sensor. Also as the garbage reaches the sensor level, message is displayed on LCD and the user will get a message in mobile using GSM technology**.

1.INTRODUCTION

Waste disposal is a huge cause for concern in the present world. The disposal method of a voluminous amount of generated waste has had an adverse effect on the environment. Unplanned open dumping at landfill sites made by municipal is a common method of disposal of waste. Human health, plant and animal life are affected due to this method.

The harmful method used for waste disposal generates harmful chemicals which contaminate surface and groundwater. It can give rise to disease vectors which spread harmful diseases. This also degrades the aesthetic value of natural environment can degrade the aesthetic value of the natural environment and it is an unavailing use of land resources.

In India, rag pickers play an important role in the recycling of urban solid waste. Rag pickers and conservancy staff have higher morbidity due to infections of the skin, respiratory, gastrointestinal tract and multisystem allergic disorders, in addition to a high prevalence of bites of rodents, dogs and other vermin. Dependency on the rag-pickers can be diminished if segregation takes place at the source of municipal waste generation.

The economic value of the waste generated is not realized unless it is recycled completely. Several advancements in technology have also allowed the refuse to be processed into useful entities such as waste to energy, where the waste can be used to generate synthetic gas (syngas) made up of carbon monoxide and hydrogen. The gas is then burnt to produce electricity and steam; Waste to Fuel, where the waste can be utilized to generate bio fuels.

When the waste is segregated into basic streams such as wet, dry and metallic, the waste has a higher potential of recovery and consequently recycled and reused. The wet waste fraction is often converted either into compost or methane-gas or both. Compost can replace demand for chemical fertilizers, and biogas can be used as a source of energy. The metallic waste could be reused or recycled.

Even though there are large-scale industrial waste segregators present, it is always much better to segregate the waste at the source itself. The benefits of doing so are that a higher quality of the material is retained for recycling which means that more value could be recovered from the waste. The occupational hazard for waste workers is reduced. Also, the segregated waste could be directly sent to the recycling and processing plant instead of sending it to the segregation plant than to the recycling plant.

1.1 PROBLEM DEFINITION

1.1.1 EXISTING SYSTEM

Many entities, public and private, have the responsibility for managing solid waste. These include state and local governments, the waste /management industry, residents, manufacturers of products, retailers and other business groups.

An integrated waste management system is an essential component of the infrastructure of a sustainable community. An integrated solid waste system protects public health, supports a vibrant economy, reduces emissions of air pollutants such as greenhouse gases, conserves energy and resources, and produces renewable energy. The solid waste management hierarchy emphasizes source reduction, reuse, recycling, organics recovery, and resource recovery over land disposal.

1.2 PROBLEM SOLVING

1.2.1 OBJECTIVES

Smart waste management is a idea where we can control lots of problems which disturbs the society in pollution and diseases. The waste management has to be done instantly else it leads to irregular management which will have adverse effect on nature. The Smart waste management is compatible mainly with concept of smart cities.

The main objectives of our proposed system are as follows:

1. Monitoring the waste management.
2. Providing a smart technology for waste system.
3. Avoiding human intervention.
4. Reducing human time and effort
5. Resulting in healthy and waste ridden environment.

This project falls under the category of embedded systems and android applications.

1.2.2 TECHNICAL BACKGROUND

The mixed waste is sorted based on the following methods at the industrial level. Larger items are removed by manual sorting. Then the refuse is sorted based on its size by using large rotating drums which are perforated with holes of a certain size. Materials smaller than the diameter of the holes will be able to drop through, but larger particles will remain in the drum. For metallic objects electromagnets or eddy, current based separators can be used. Near-infrared scanners are used to differentiate between various types of plastics based on the ability of the material to reflect light. X-rays can also be used to segregate materials based on their density. The methodology adopted in this paper to resolve the issue of waste segregation

by making the entire process automated and to the reduce cost such that it could be adapted in a household level.

1.2.3 SCENARIO IN KERALA

The rapid urbanization, constant change in consumption pattern and social behaviour have increased the generation of municipal solid waste (MSW) in Kerala beyond the assimilative of capacity of our environment and management capacity of the existing waste management systems. Therefore, there is an urgent necessity of improved planning and implementation of comprehensive MSW management systems for upgrading the environmental scenario of the State.

It requires detailed information on the quantity and character of MSW generated and their physical and chemical properties. This is to evolve appropriate waste management strategy based on the principles of reduce, reuse and recycle and design appropriate collection, transportation, processing and disposal system. It requires reliable data on quantity and quality of MSW generated in the State. Therefore, an attempt is made here to present the details of available data on the quantity and character of MSW generated at various parts of the State for planning further studies on the aspect.

Based on the studies carried out by the Centre for Earth Science Studies and data compiled by the Clean Kerala Mission for all the Municipalities and Corporations of the State, the average daily per capita generation comes to 0.178 kg with a very high variation from0.034 kg for Koothuparamba to 0.707 kg for Thalassery (CESS, 2001; Padmalal& Maya, 2002; Varma&Dileepkumar, 2004). This is due to the fact that the quantification of generation from different types of sources has not been done in any of the ULBs by direct method of source wise sample surveys or by indirect method of assessing collected waste, uncollected quantities and that separated for recycling and reuse.

The studies carried out by the National Environmental Engineering Research Institute (NEERI) in Indian cities have revealed that quantum of MSW generation varies between 0.21-0.35 kg/capita/day in the urban centres and it goes up to 0.5 kg/capita/day in large cities (NEERI, 1996). Considering this, the waste generation in the Municipalities of Kerala can be taken as a minimum of 0.21 kg/capita/day with an increment due to the increasing trend of waste generation and that the estimate was that of 1996. The studies conducted by the Urban Development Section (East Asia and Pacific Region) of the World Bank, considering the relation between GNP and per capita waste generation, indicated that the rate of waste generation is estimated to grow at an exponential rate of 1.41 per cent per annum. Therefore, the present minimum generation of MSW can be considered as around 0.242 kg/head/day. Accordingly, the daily MSW generation in the Municipalities of the State as per the norms derived.

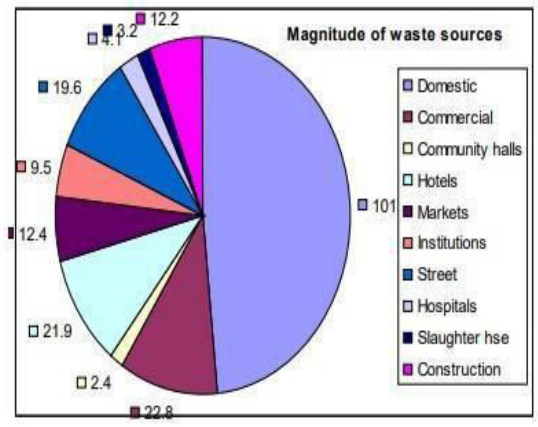


Fig1.1:Magnitude Of Waste Sources

2. LITERATURE REVIEW

Amrutha Chandramohanet. al.[1] states there is no such system for segregation of wastes into categories such as dry, wet and metallic wastes at the household level. An Automated Waste Segregator (AWS) can be used at the household level so that the waste can be sent directly for processing. The AWS employs inductive sensors to identify metallic items, and capacitive sensors to distinguish between wet and dry waste depending upon the threshold values set. However, it cannot segregate ceramic into dry waste because it has the higher relative dielectric constant as compared to other dry wastes that are segregated. By increasing accuracy and overall efficiency, we can eliminate noise.

The limitations of this system are it can segregate only one type of waste at a time with an assigned priority for metal, wet and dry waste. Thus, buffer spaces can be used to segregate a mixed type of waste. Since the time for sensing metal objects is low the entire sensing module can be placed along a single platform where the object is stable to ensure better results.

Nishigandha Kothari et. al.[2] used Ultrasonic Sensors are used to monitor the garbage collection.Whenthegarbagereachesthesensorlevela ninterruptissenttothemicrocontroller.

J.S. Bajaj et. al.[3] says many upgradations can be done to the existing project. Some of which are listed below: Advanced processing techniques can be incorporated once the waste has been segregated, methods for individual material feeding for local use so that the segregation can be performed continuously once the waste is dumped, image sensing can be used to segregate materials through Image processing technology.

RashmiM. Kittaliet. al.[5] says that even PLC can be used for AWS. It has an advantage of reduced manpower, improved accuracy and speed of management of waste. It also avoids the risk of working in hazardous places. This work can be implemented by making use of a robotic arm in the future to pick and place certain materials which can be re-used. The bins can be unloaded by placing limit sensors at the top of each bin.

Depending upon the above survey we will be implementing an AWS using Ar- Arduino UNO with a feedback system which will be implemented using an Ultrasonic Distance Measure Sensor, and as the garbage reaches the sensor level which is attached in the bin an interrupt is sent to the microcontroller and a message is displayed on LCD saying bin is full and the microcontroller enters low power mode till it is not reset.

We had proposed a standing model for the system to be implemented but to improve the accuracy and feasibility of the system and to make the system cost effective we chose to make a system using a conveyer belt and mounting different sensors at the sides of the belt so as to segregate waste.

3. BLOCK DIAGRAM

Once the input waste is placed on the top of the bin, sensors are turned on and the sensing and segregation start. The IR sensor, metal sensor, the moisture sensor and the ultrasonic sensors that are used to get the segregators in place are given as input to Arduino MEGA. The output is the final segregated wastes into different bins.

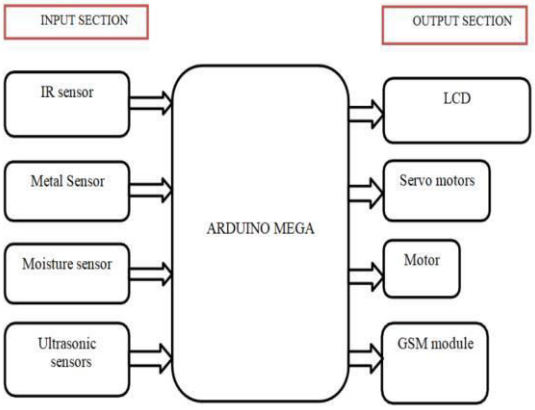


Fig 3.1: Block Diagram

3.1.ENTRY SYSTEM AND INITIALIZATION

The waste is dumped into the AWS by pushing it through a flap. This flap comes in the proximity of the IR proximity sensor which marks the entry of the waste. The sensor sends an interrupt to the microcontroller which comes out of the low power mode. It then initializes the sensor modules. The initialization of all modules ensures that any dynamic changes in the environment do not affect the sensing.

3.2.METAL DETECTION SYSTEM

The object moves and falls on the metal detector which comprises of an inductive coil. The inductive coil is a part of a parallel inductance and capacitance (LC) circuit. This measures the parallel resonance impedance of a parallel LC circuit and returns data as a proximity value. This data changes whenever another metallic object is introduced in the vicinity of the coil. When an alternating current is passed through a coil it generates a magnetic field . When a metallic object is introduced in the vicinity of the coil, eddy currents are induced on its surface. The eddy currents are a function of the distance, size, surface area and composition of the target. This generates a magnetic field which opposes the original magnetic field which is generated by the coil.

The inductive coupling between the coil and the object creates a mutual inductance effect on the coil which decreases the parallel resonant impedance of the circuit which in turn is reflected the motor. Thus the segregation is completed.

by an increase in the proximity count value. Magnetic fields do not affect the metal detection system. It can detect any conducting material irrespective if its magnetic properties.

3.3.DRY/WET DETECTION SYSTEM

We make use of a moisture sensor to identify whether the waste is dry/wet. The voltage of the sensor change accordingly to the water content in the waste.

When the waste is wet, the output voltage decreases and if the waste is dry ,the output voltage increases. The output is a digital signal ,that is low or high, depending on the water content.

3.4.SEGREGATION MODULE

To achieve the segregation, two servomotors are used. The containers are placed on a circular base which is mounted on the axle of a servo motor. The circular base rotates as the axle of the servo motor rotates.

If the container corresponding to the type of garbage is not under the flap then the motor is rotated clockwise or anticlockwise. he servo motor is given four different positions or angles for the four types of wastes detected. The motor thus always comes to the required position according to the signal obtained. The default bin at the circular base is the dry bin. To avoid overshooting of the container due to the momentum of the base, the servo motor is rotated at lower speeds by using pulse width modulation (PWM) which is generated from the microcontroller's timer.

Once the required container is positioned under the flap, a second servo motor lowers the collapsible flap by rotating the motor clockwise by 180° it then waits for 2 seconds to ensure that the waste falls down and finally raises the flap back to the initial position by rotating the motor anticlockwise.

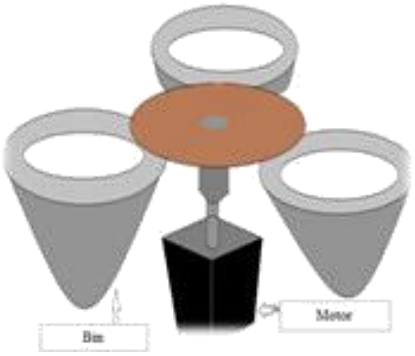


Fig 3.2:Segregation Module

3.5.LEVEL DETECTION

When the waste reaches beyond a limit,an ultrasonic sensor detects it and accordingly aurdino board gives control signal to GSM module,there by a message is displayed on the LCD screen indicating that corresponding bin is full.Also a message is send to user's mobile so that the user can remove the waste from the bin.

3.6 FOOD RECYCLING UNIT

We have done a simulation using DC motor.When wet waste is identified,the corresponding bin comes to the position and comes back to its default position,after few seconds .Also it activate the dc motor,where the wet waste waste is coverted to crushed form,so that it can be used as manure.

4. FLOW CHART

The algorithm of the project is as follows:

Step-1: When the waste put on top of the bin, motor turns on and the cap start moving.

Step-2: The microcontroller, all the motors, and sensors are turned on presence of waste detected by IR sensor.

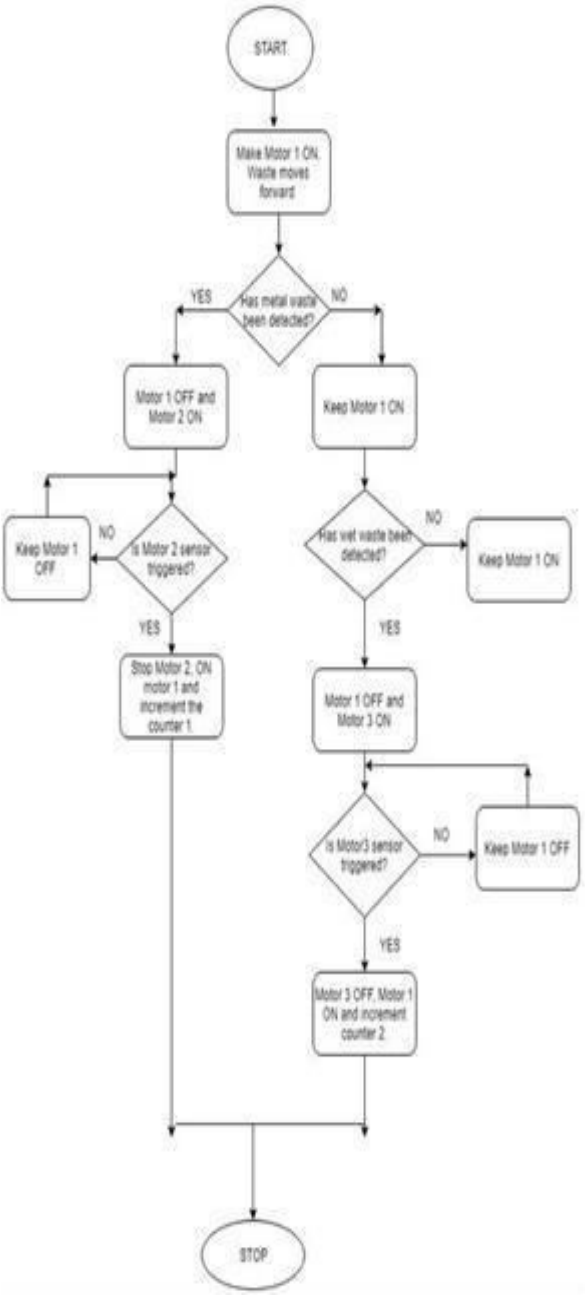
Step-3: The waste is sensed by the inductive proximity sensor to detect if it is a metal or no.

Step-4: If the waste is metal waste then the waste is pushed into the metal waste bin.

Step-5: If not a metallic waste, M1 is kept on when it comes in contact with the moisture sensor that decides whether the waste is a wet waste or dry waste by checking the moisture content of the waste.

Step-6: If the waste has some humidity it is detected as wet waste the waste is pushed into the wet waste bin.

Step-7: If not a wet waste M1 is kept on and then the waste is dropped into the dry waste bin Step-8: Finally the wastes are dropped into the respective bins and the segregation process is completed.



5.HARDWARE

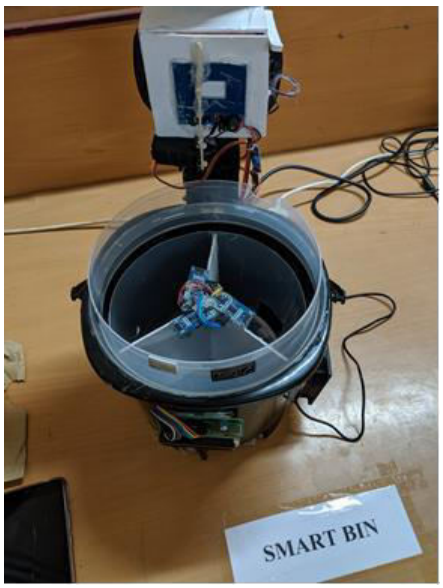


Fig 5.1 :Smart Bin

This project work implements an automatic waste segregator using IR sensor, ultrasonic sensor, metal detector, moisture sensor, servo motor, dc motor and GSM module. Our Smart Bin segregates waste into metal, dry and wet.

Waste is pushed through a flap into the system. An IR proximity sensor detects this and starts the entire system. Waste then falls on the metal detection system. This system is used to detect metallic waste. After this the object falls into the moisture sensing module. This module distinguishes between wet and dry waste. After the identification of waste, a circular base which holds containers for dry, wet and metallic waste is rotated. The collapsible flap is lowered once the container corresponding to the type of garbage is positioned under it. The waste falls into the container and the flap is raised. This system also ensures cleaning of dust bin when the garbage level reaches its maximum, hence overflowing of waste bins can be avoided. The waste in the containers now can be collected separately and wet waste is converted to crushed form using the DC motor in food recycling unit.

6. CONCLUSION

Implementation of this system at a local level like societies, educational institutes, etc. can reduce the burden on the local authorities. The automatic waste segregator is one small step towards building an efficient and economic waste collection system with a minimum amount of human intervention and also no hazard to human life. Using a conveyor belt makes the system far more accurate, cost-effective and also easier to install and use at a domestic level. Segregating all these wastes at a domestic level will also be time-saving. While implementing our system we came across many problems like the sensing range of inductive proximity sensor, the accuracy of the moisture sensor, adjusting the range of IR sensors and some more, but using some modifications we tried the make the system as reliable as possible but not completely perfect.

7. REFERENCE

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