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AUTOMATED WASTE SEGREGATOR

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ABSTRACT

The rapid growth in the population has also led to the surge in the volume of waste being generated on a daily basis. This increase in the generation of waste due to continuous growth in the urbanization and industrialization has become a severe problem for the local and the national government. It is also posing a serious problem for the local authorities to manage the wastes being dumped everywhere as landfill. To ensure the minimal risk to the environment and human health, it is necessary to take meticulous measures when segregating and transporting waste. Segregation of waste in a proper manner brings to the limelight actual economic value of the waste. The traditional method used for segregating of waste in India is through rag pickers which are time-consuming and can have adverse effects on the health of the people who are exposed to such wastes. Here we propose the use of an Auto Waste Segregator (AWS) which is cheap and also an easy to use solution for segregation of household waste. It is designed to segregate the waste into three categories viz. metallic, dry and wet waste. The system makes use of moisture sensor for the segregation of wet and dry waste and inductive proximity sensor for the detection of metallic waste and an LCD display for displaying the result of segregation. It is evident from experimental reports that segregation of waste using AWS has been successful.

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

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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.

Currently, there is no efficient system of segregation of dry, wet and metallic wastes at a household level. J.S. Bajaj [3] has recommended that the least cost, most appropriate technological option for safe management should be developed. The purpose of this project is the realization of a compact, low cost, and user-friendly segregation system for urban households to streamline the waste management process.

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

ORGANIZATION OF THE REPORT

The report is organized as follows:

- Chapter II – encompasses the review of the literature, which has a complete comparison of the different technologies and choosing the best out of them.
- Chapter III – contains the proposed solution to overcome the drawbacks of the previously implemented systems.
- Chapter IV – consists the different component details used in the project.

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- Chapter V – states the conclusion of the entire project implemented and its future applications.

REVIEW OF LITERATURE

- Amrutha Chandramohan et. 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. When the garbage reaches the sensor level an interrupt is sent to the microcontroller. 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.

- Rashmi M. Kittali et. 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.

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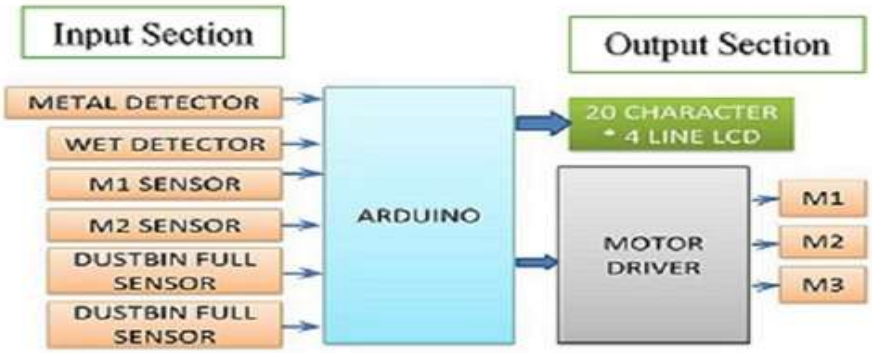
DESIGN CIRCUIT

Block Diagram



The components of the proposed system are:

- M1: Motor driving the conveyer belt.
- M2: Motor driving the segregator to put metal waste into the bin.
- M3: motor driving the segregator to put the wet waste into the bin.

Once the input waste is placed on the conveyer belt, the conveyer belt starts moving and all the sensors are turned on and the sensing and segregation start. The metal sensor, the moisture sensor, the feedback sensors and the motor sensors that are used to get the segregators in place are given as input to Arduino UNO. The output is the final segregated wastes into different bins.

Flow Chart

The algorithm of the project is as follows:

- Step-1: When the waste enters the conveyer belt motor turns on and the conveyer belt starts moving.
- Step-2: The microcontroller, all the motors, and sensors are turned on.
- 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 M1 is turned off and M2 is turned on and the waste is pushed into the metal waste bin. Also, the counter 1 is incremented (keeps a count of a number of metal wastes dumped).
- 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 and M1 is turned off and M3 is turned on and the waste is pushed into the wet waste bin. Also, the counter 2 is incremented (keeps a count of a number of wet waste being dumped).
- Step-7: If not a wet waste M1 is kept on and then the waste is dropped into the dry waste bin placed at the end of the conveyer belt.
- Step-8: Finally the wastes are dropped into the respective bins and the segregation process is completed.

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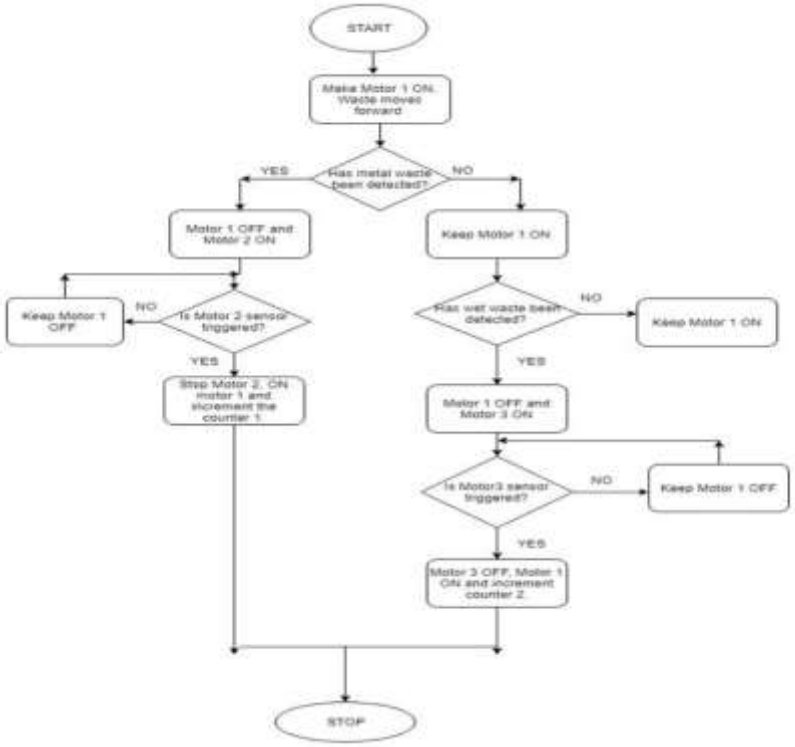
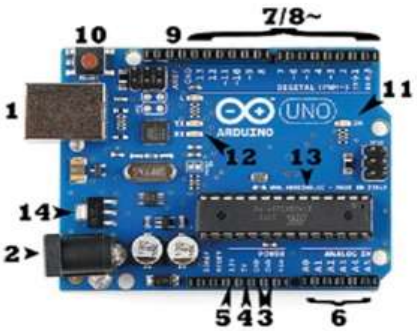


IMPLEMENTATION OF THE PROPOSED AUTOMATED WASTE SEGREGATOR SYSTEM

Arduino UNO

The Arduino Uno is a popularly used open-source micro-controller board that runs on AT mega 328P micro-controller. This board is developed by Arduino.cc which is an Italy based hardware company. This board contains a set of digital and analog I/O data pins that are used to interface this board with other electronic components. Arduino Uno consists of 14 digital pins and 6 analog pins. This board can be programmed with the help of Arduino IDE (Integrated Development Environment) that supports embedded C, its back-end is constructed using JAVA. Uno consists of an USB port through which the code can be uploaded on to the board. This post can also be used to power the board by connecting it to a laptop, PC, etc. Along with a USB port, it also has a DC input power jack. An external battery of 9V can also be used to power Arduino board.



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Technical Specifications:

1. Operating Voltage: 5V
2. Input Voltage: 7-20V
3. DC current per I/O pin: 20 mA
4. Flash Memory: 32 KB
5. Clock Frequency: 16 MHz.
6. No. of digital pins: 14
7. No. of analog pins: 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

FUTURE SCOPE

This type of product can be used in housing societies, offices, etc. Since it is cost effective, it can be implemented on a large scale as well with some modifications. Using a robotic arm along with a conveyor belt will make the process of segregation easier.

Also, more sensors can be used to segregate bio-degradable and non-bio-degradable waste, plastics, recyclable waste, e-waste, and medical waste.

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