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Design and Development of Automated Waste Segregator

Baliram Vitthal Wayal¹, Prasad Balasaheb Shinde², Shubham Kailas Wagh³, Tinesh Hetram Dhole⁴,

Dr.V.S. Sampathy⁵

U.G. Student, Department of Mechanical Engineering, SKN Sinhgad Institute of Technology & Science,
Maharashtra, India

Associate Professor, Department of Mechanical Engineering, SKN Sinhgad Institute of Technology & Science,
Maharashtra, India⁵

ABSTRACT:Waste Management and segregation is a much-needed process in metro cities and urban areas due to spreading of diseases. It is estimated that India produces 42.0 million tons of municipal solid waste annually at present. Waste lying littered in the surrounding, dumped on open lands, becomes a major problem for various types of disease-causing bacteria and viruses hence, segregation, transport, handling and disposal of waste must be managed properly to minimize the risks of the public and environment. When mixed dry and wet waste breaks down in lowland, it creates nasty greenhouse gases. Segregation makes it attainable to utilize and recycle the waste effectively. This waste segregator system can easily segregate waste. The metallic, plastic and paper waste can be reused or recycled. An automated waste segregation process is the most basic requirement for kick-starting management process. Thus in this paper, we have compared various automated waste segregation processes implemented using different technologies.

KEYWORDS:Automatic waste segregator, waste management, microcontroller, plastic separation

I. INTRODUCTION

Waste Management and segregation is a much-needed process in metro cities and urban areas due to spreading of diseases. It is estimated that India produces 42.0 million tons of municipal solid waste annually at present. Waste lying littered in the surrounding, dumped on open lands, becomes a major problem for various types of disease-causing bacteria and viruses hence, segregation, transport, handling and disposal of waste must be managed properly to minimize the risks of the public and environment. When mixed dry and wet waste breaks down in lowland, it creates nasty greenhouse gases. Segregation makes it attainable to utilize and recycle the waste effectively. This waste segregator system can easily segregate waste. When waste is thrown in the pipe, IR sensor will sense the waste. Waste is divided into three categories namely Wet, Dry and Metallic. Another sensor will sense the garbage category. As per the algorithm used, if the waste is metallic then the mechanism will bring the metal collecting bin below the pipe and with the help of servo motor the waste will fall into the metal bin. Similarly, the process will repeat if wet waste is sensed. If the sensor doesn't activate both the sensor category, then the waste will be considered to be a dry waste. Segregation of collected waste is essential due to the fact that if all waste materials such as polythene bags, old furniture, and e-waste get mixed up in the landfills, it could lead towards contamination of the land through leaking toxic substances. Wet waste fraction is converted either into compost or methane gas. Compost can replace chemical fertilizers demands, and biogas can be used as a source of energy. The metallic, plastic and paper waste can be reused or recycled. An automated waste segregation process is the most basic requirement for kick-starting management process. Thus in this paper, we have compared various automated waste segregation processes implemented using different technologies.

II. RELATED WORK

In today's world common problem faced in waste collection and dumping is mainly: overflowing garbage bins and waste segregation as per its type. Nearly 62 million tons of waste is generated each day by 377 million people living in urban India of which 45 million of waste is left untreated and disposed of unhygienic ally causing severe health

problems and environmental degradation. A range of notable inflation in the municipal solid waste generation has been registered worldwide due to overpopulation, industrialization and economic growth and overflowing landfills are impossible to reclaim because of the improper disposal of wastes on outskirts of cities causing vital environmental entanglement in terms of water pollution and global warming causing a reduction in average lifetime of the manual segregator. In India, rag pickers and conservancy staff play a crucial role in the recycling of urban solid waste and have higher jejuneness due to infections of the skin, respiratory system, gastrointestinal tract, and other allergic disorders. This can be diminished if segregation takes place at the source of the municipal waste generation which will also give a higher quality of the material is preserved for recycling thereby recapturing more value from the waste. This not only reduces occupational hazard for rag pickers but also reducing the processing time of segregating the waste after collection. The economic value of the waste generated is realized after it is recycled completely and there are different techniques available to recycle and reuse the municipal solid waste. When the waste is segregated into basic categories such as wet, dry and metallic, it has an intense perspective of improvement, and accordingly, recycled and reused.

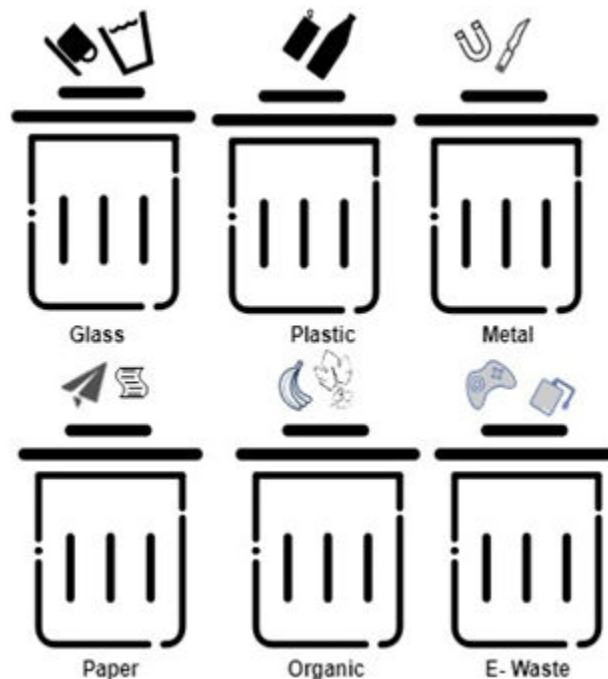


Fig. 1. Waste Segregation

To study existing systems of garbage segregation. To utilize simplest technique for garbage separation. To study automation as for segregating waste. To manufacture Arduino based simple automation. Reduced time required for waste separation. To develop low cost machine and easily operable by any one. Waste segregation is extremely crucial due to the fact that if all waste materials such as polythene bags, old furniture, and e-waste get mixed up in the landfills, could lead to contamination of the land and water through leaking harmful substances in the atmosphere. Moreover, non-segregation also affects climate change which may lead to drought conditions. Thus, it is essential to separate waste before disposing into the landfill. Waste segregation is also not only important but also beneficial for human beings. The recyclable parts of the waste can be recycled into useful resources after the segregation process. It has a large meaning for the current society which is facing the problem of resource shortage.

III. METHODOLOGY

The necessary code for controlling the sensors and the motors is coded using embedded-C language, in which the inputs and the output ports can be defined easily. In this project we have used IDE compiler to compile the code and upload it to the board using an A-B wire. To provide details of every decision we have used an Liquid Crystal Display device to display the decisions made by the arduino processor. NodeMCU is a component which can be used to connect to a wifi hotspot using the 802.11 protocol. NodeMCU when interfaced with ARDUINO MEGA can be used for

providing real time updates, through updating the decisions made by the device on to the specific server, from where the status of the device can be monitored

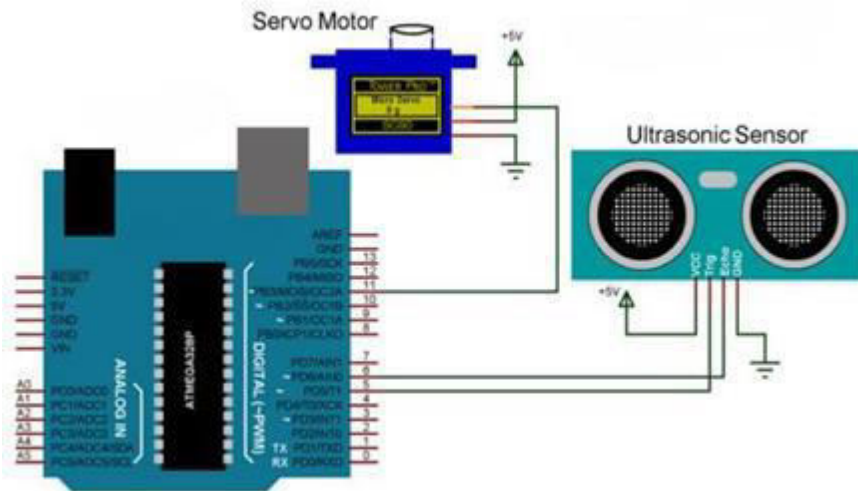


Fig. 2. Connection Diagram

The automated process of segregation starts with the detection of garbage in the first compartment, where an IR sensor and a metal detector are placed. The IR sensor is used for the detecting the presence of garbage in the compartment and the process of separation begins. once garbage is detected by the IR sensor the metal detector becomes active and verifies if the garbage is of metal wastes. When any metal object is present near the metal sensor the magnetic field around it induces current in the metal object, hence creating a loss and change in the electric field. Once metal is detected the contents in the first compartment are sent directly to the storage compartment, where three separate bins are used for metal, dry and wet waste.

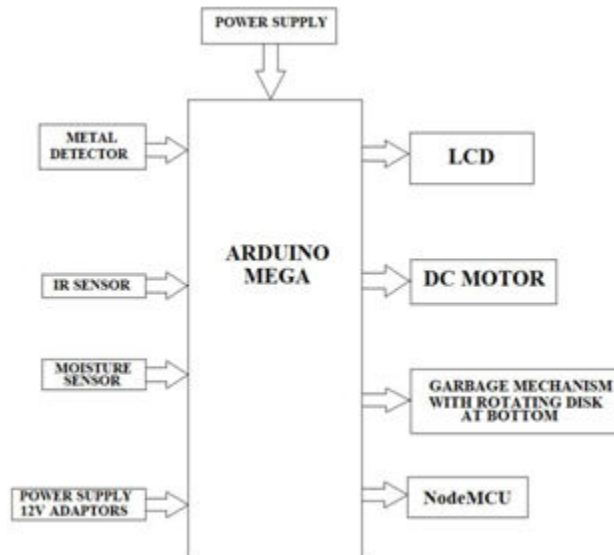


Fig. 3. Block Diagram

When the contents of the first compartment are deemed to be non-metallic, they are sent to the second compartment where an IR sensor is used to verify the presence of the garbage. Depending on the output given by the IR sensor the moisture sensor gets activated or stays inactive. When the garbage is detected in the second compartment, the moisture sensor becomes active and is used to decide if the contents to be dry or wet waste. The decision is made using the change in the dielectric constant (solid bulk permittivity). The storage compartment consists of a rotating table with three bins namely dry, wet and metal. The rotating table rotates according to the type of garbage detected in the

previous compartments, for collecting the respective waste and after collection of garbage resets to a default position. The placement of the bin for collection is programmed using delay/time taken for the table to rotate. We have interfaced a NODEMCU module which gives us a feedback on the filling of bins. This module also helps us to send information about the filling of bins to municipal corporation so that they can come and collect the waste. Initially all the servo motors are set to the home position and all the sensor are switched on. When the garbage dropped on the sensing board all the sensors sense the waste and give the sensed output to the Arduino. And the Arduino analysis the outputs to find the appropriate waste material type. Once the waste material is identified then servo motor rotate predefined angle to put the waste in the appropriate bin.

In this proposed model we try to differentiate three waste materials namely wet, metal and dry.

IV. EXPERIMENTAL RESULTS

Figures shows the Mechanical Part of the Project. The entire model has been designed with the help of designing software solid works. With the help of colour feature the colours are given to the entire model.

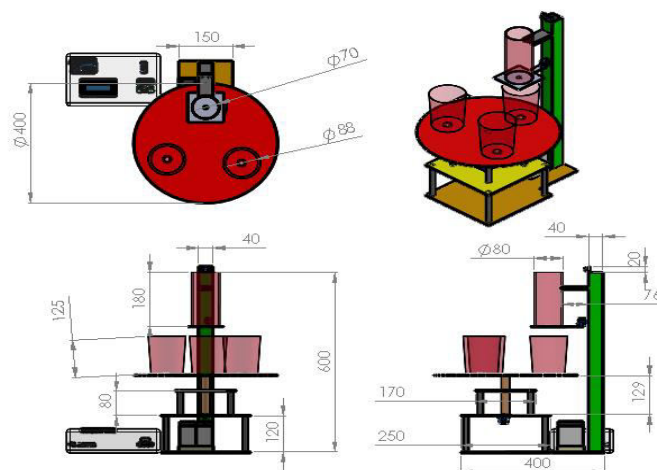
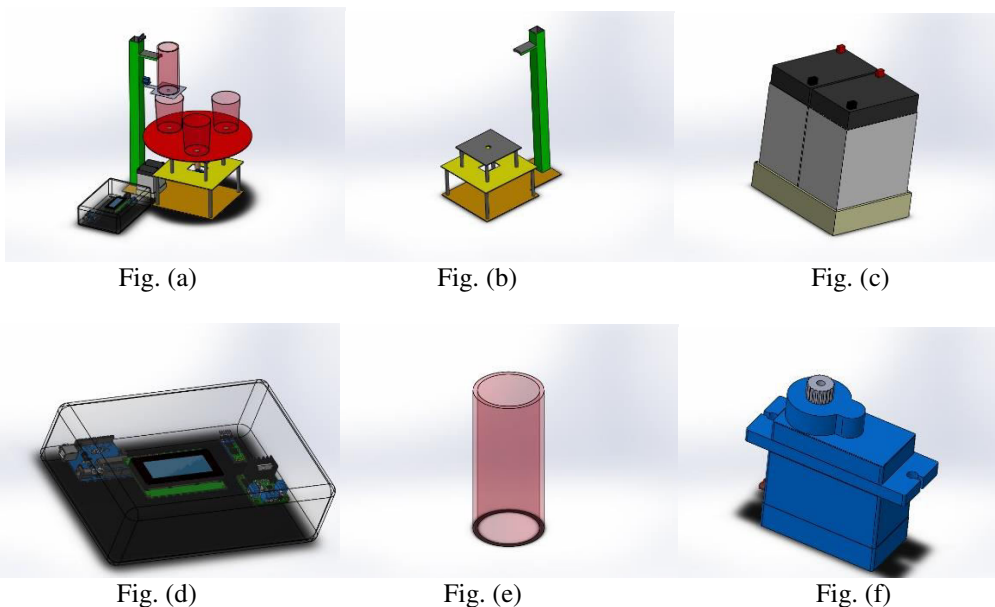


Fig. (g)



V. CONCLUSION

In this paper, the development of automated waste segregator system is presented to effectively sort waste according to its base. During the process of development, the bin prototype and sensing mechanism are integrated with an Arduino Mega microcontroller. It is a low-cost system and it requires less amount of power supply. 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. Due to rise in urbanization the waste is increasing very fast. Therefore, waste management is the vital need to protect the environment. The technological growth and innovation can contribute to this vital aspect to achieve environmental stability. To manage waste and monitor it properly at the base level are the compelling reasons for choosing these approaches. The base level sorting helps Municipal Corporation to dump it properly and recyclables can be recycled. This system is helpful in dry and wet waste separation, and monitoring the garbage containers. The system is an efficient step towards cleanliness. As it is being said that the technology which goes parallel with environment is the need of the hour. Our project is a step towards such green technology

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