AUTOMATIC SEPARATION OF MUNICIPAL WASTE USING PLC AND SMART HOPPER

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ABSTRACT: Now-a-days the wastes are dumped as landfill waste and the major problem in solid waste disposal is plastic bottles, glass bottles, metal can separation and they are separated manually and recycled. [2] Mission clean India campaign has motivated people for not disposing household waste in open land. The domestic wastes are collected in two bins provided to the every citizen by the municipal corporation. The municipal corporation has broadly classified the waste in two category i.e. dry waste and wet waste. Most of the waste collecting agencies are finding difficulty in separation of dry and wet waste due to poor awareness amongst the citizen. All the wet waste is basically degradable where as dry waste are non-degradable. So is very important to separate the degradable and non-degradable waste for recycling and developing compost for green uses. This paper aims in providing effective solution for the separation of the municipal waste by using custom hopper which is controlled by programmable logic controller. The successful separation of the waste lays the path for the onsite effective utilization of the bio-degradable waste as compost, manure etc.

KEYWORD: programmable logic controller, municipal waste, sensor, hopper, conveyor belt.

INTRODUCTION: The discipline associated with the control of generation, collection, storage, transfer and transport, processing and disposal of municipal waste in a manner that is in accord with the best principles of public health, economics, engineering, conservation aesthetics and other environmental considerations. The separation of municipal waste is the one of the most important process. The municipal can be broadly classified as bio-degradable and non-Biodegradable waste. However it is not an end process of managing the municipal waste, but actually it is the beginning the management of municipal waste [6]. This paper provides an effective separation scheme using PLC.

LITERATURE REVIEW: Khalid Chahine et.al introduces an automated solid waste sorting system. The developed system is equipped with a programmable logic controller, an inductive proximity sensor, a capacitive proximity sensor, and a photoelectric sensor. Multi-sensor data fusion is used so that each material result in a different combination of sensor output [1]. M. Deepak, S. Karthik gives the automated waste segregation. They are developed a prototype for separating plastic, glass bottle and metal cans from solid waste material using programmable logic controller (PLC) S7-300. They were used different capacitive, proximity sensor etc. [2]. Mangesh B. Nagapure and Dr. Deshmukh give a novel method where the provision is given to separate out metal and nonmetal waste into respective bins by sensing of different sensors incorporated along the conveyor belt [3]. P. Thirumuruganand R. Aravind is described they have done a simple conveyor based system which separates the metal from non-metals. This will be useful in the waste segregation process. This system will separate the metal using the programmable logic controllers (PLC) and a simplr conveyor system will helps to segregate the metals [4]. Rahul Deshmukh, Chinmay Joshi, Yash Bachhav, Sachin More and Amit Mishra were proposes a novel method where the provisions is given to separate out metallic and plastic waste into respective bins by the sensing of different sensor incorporated along the conveyor belt [5]. Rashmi M. Kittali and Ashok Sutangundar are given to separate out wet and dry waste into respective bins by the sensing of different sensors incorporated along the conveyor belt on which initially crushed waste is moving. Piece of glass, paper, metallic materials and waste are separated out from proposed work [6]. S. M. Dudhal, B.S. Jonwal and prof. H.P. Chaudhari described the a prototype for separating out metals from waste material using Programmable Logic Controller. In this system the waste will be fed to the conveyor belt through an automatic feed system which will comprise of a hopper and other mechanism [7]. Siddharam, Ds Suresh, Rajendra CJ, Sekar R gives system, the grinded kitchen waste pass to the heating chamber to convert the gel from of

material into a dry product. The dry form of product can be used as manure [8]. This paper described onsite effective utilization of municipal waste and separation of bio-degradable and non-biodegradable waste using programmable logic controller.

PRINCIPLE: The separate municipal waste into bio-degradable and non-biodegradable is done using specially designed hopper whose operation is controlled by programmable logic controller. The separation of municipal waste is carried out automatically with minimum human intervention.

METHODOLOGY: The programmable logic controller is the brain of project. The automation of the waste separation is done automatically. The municipal waste is put on the specially designed hopper and that hopper is connected to PLC from where it receives necessary action command [7]. The schematic block diagram for the separation of municipal waste is shown in figure 1.
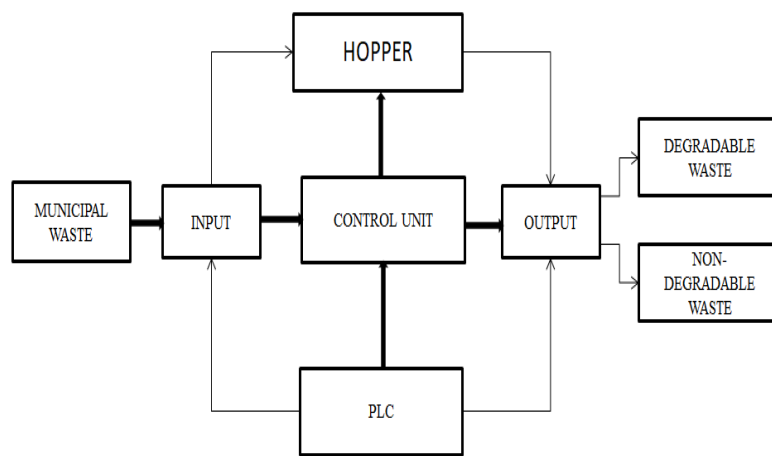

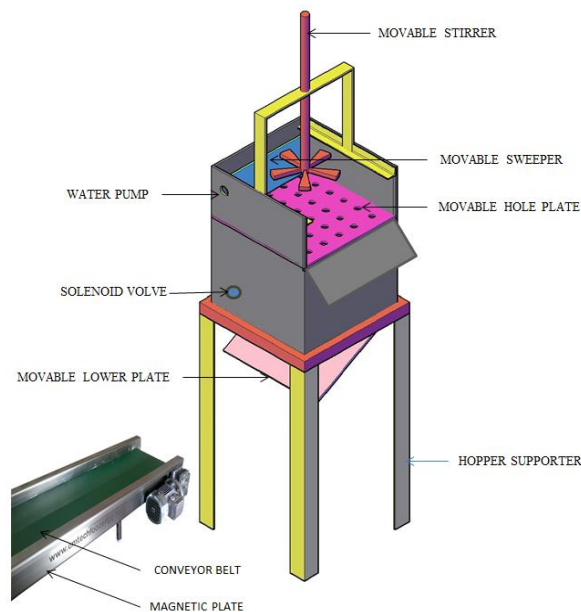Figure 1 schematic block diagram of separator

Figure2. Design of Hopper

WORKING:

- The calculated amount (kg) of the municipal waste is poured in special designed hopper.
- A fixed amount of water is automatically added to the hopper containing municipal waste using motor -1.
- Now PLC will turn-on stirrer for specified period of time, the stirrer is connected with motor-2.
- The hole-plate goes up with accumulated non-degradable waste at the upper side of the hopper and PLC turn ON the motor-3 the calculated amount (kg) of the municipal waste is poured in special designed hopper.
- The PLC turn ON the sweeper which sweeps out the non-degradable waste, sweeper is connected through motor-4.
- The sweeper comes back to its place after sweeping out the non-degradable waste.
- Water which used for mixing of municipal waste drain with the solenoid valve.
- The PLC turns ON the motor-6 which is connected through the lower plate. The lower plate goes down to separate bio-degradable waste.
- The bio-degradable waste is now put on the conveyor belt, this conveyor belt is magnetized which separated the small piece of magnetic material from bio-degradable waste.

Flowchart: The flow chart for the separation and onsite effective utilization of municipal waste using PLC is given in figure 2.
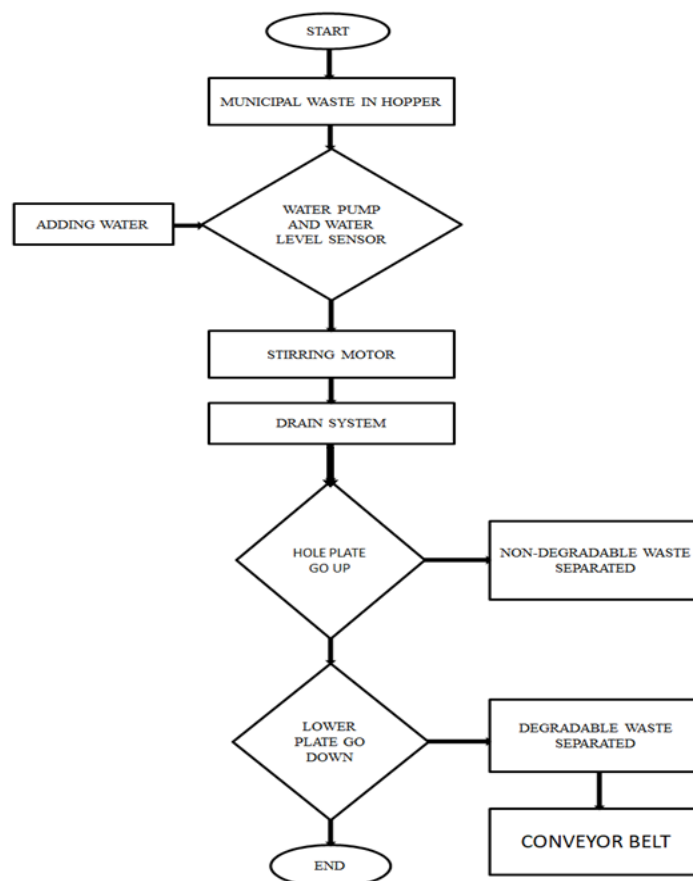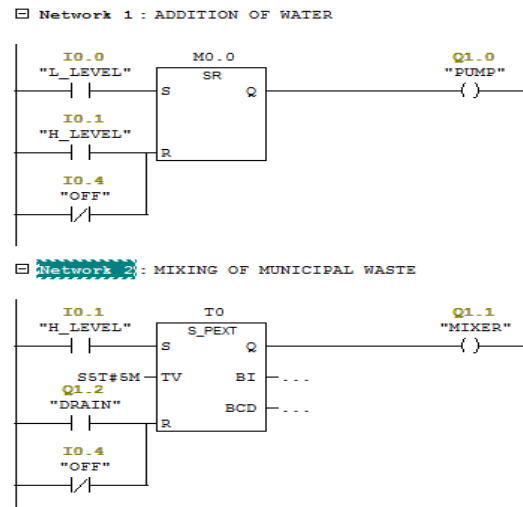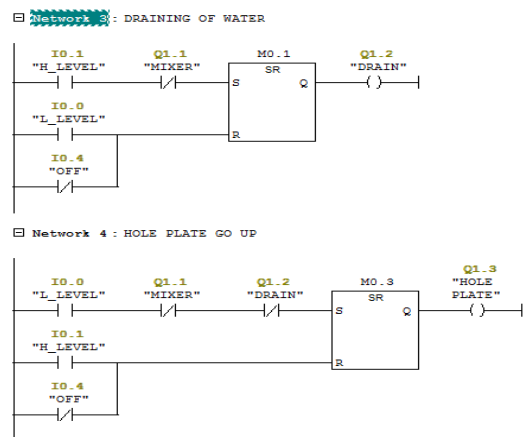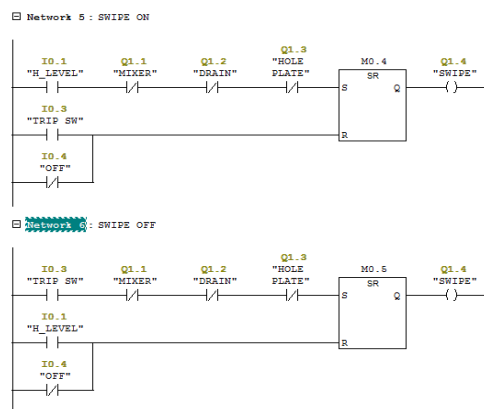

Figure 2 flowchart of separation of municipal waste

LADDER DIAGRAM: The ladder diagram written to execute this logic is as shown in below.
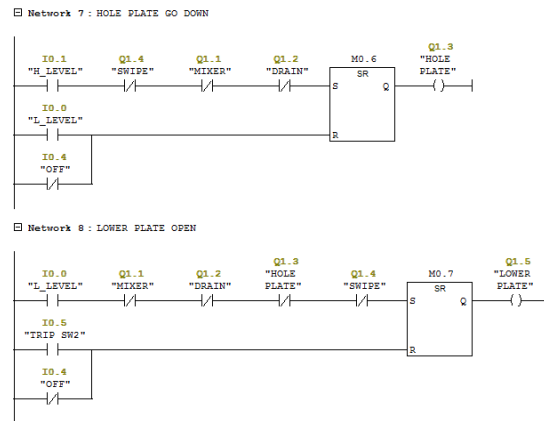

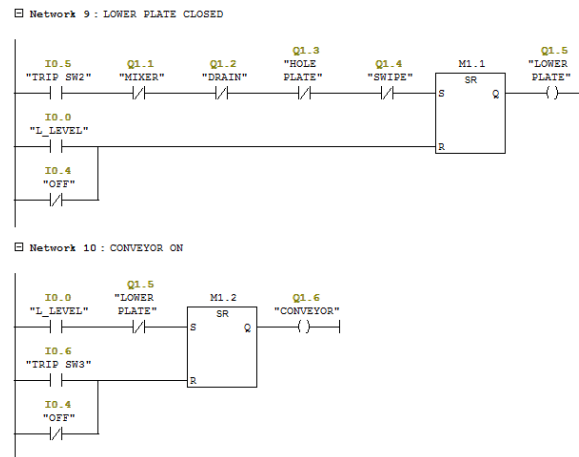1. Ladder diagram of addition of water and mixing of municipal waste

2. Ladder diagram for draining of water and hole plate operation

3. Ladder diagram for sweeper operation

(4) Ladder diagram for hole plate and lower plate operation

(5) Ladder diagram for operation of lower plate and Conveyor plate

RESULT: This project separate the bio-degradable waste and non-biodegradable waste automatically from the municipal waste and the remaining bio-degradable waste used for compost, also non-biodegradable waste recycled easily.

ADVANTAGE:

- The municipal waste separated automatically into bio-degradable waste and non-biodegradable.
- The plastic, cans, bottle, glasses from non-biodegradable waste which is automatically separated from municipal waste is recycled for reused.
- The small piece of magnetic material is easily removed from bio-degradable waste using magnetized conveyor belt.
- Minimum time required to separate the municipal waste.

DISADVANTAGE:

- Crushed glass not removed easily.
- Pebbles are difficult to remove.

CONCLUSION: The separation and onsite effective utilization of municipal waste using PLC is separate the municipal waste into bio-degradable waste and non-biodegradable waste. The bio-degradable waste is used for making compost, and non-biodegradable waste is recycled. The small piece of glass and pebbles are not easily removed. The separation of municipal waste can be achieving 70-80%.

FUTURE SCOPE:

- Plastic, cans, bottle and glasses are recycled.
- The separated bio-degradable waste is used for making compost.
- By using this proposed scheme will be helpful to easily achieve our mission clean India.

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