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# Waste Collection from Stagnant Water Bodies and Segregation using Artificial Intelligence and Raspberry Pi

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***Abstract*** **- With the increase in population, the scenario of cleanliness with respect to waste management is degrading tremendously. The vast volume of waste created necessitates laborious human cleanup procedures. The development of technology across all industries has made automated garbage-pile prevention methods possible. Waste segregation is intended to make disposal of collected waste simple. Once the waste has been collected, it must be segregated, as segregation aids in recycling and reduces the amount of waste sent to landfills, making it less expensive and better for people and the environment. Our project aims at collecting floating wastes from the water bodies with help of a waste collecting belt and is dumped onto the main conveyor belt for segregation into various categories with the help of artificial intelligence. The whole system is under the control of the Raspberry pi processor.**

***Key Words: Waste segregation, Artificial Intelligence, Bluetooth, Raspberry Pi***

## 1. INTRODUCTION

The buildup of floating garbage such as plastic fragments, foam scraps, or tree leaves on City Rivers or Ponds in developing countries can clog water channels and pollute the environment. As a result, keeping the water surface clean is a must-do task Waste removal is typically done by hand, which carries a high level of risk. Thus, the cleaning of floating wastages from rivers or ponds is important to make sure that water is cleaned and maintain a healthy environment. In spite of creating a lot of awareness, people use to throw the wastes into the ponds which in turn decomposes day-by-day and causes a lot of diseases. Manual cleaning of such ponds involves a great deal of risk, as the individual could become sick. Also, there's an enormous risk for vulnerable aquatic species, this project is designed such that the waste is collected from the water bodies with the help of a simple mechanism attached to the machine. Once the waste is collected from the ponds or rivers, it is segregated. Using modern Machine Learning technologies, the waste segregator system tries to automate the segregation. High accuracy of segregation outcomes can be accomplished with the use of a sophisticated deep layered network called Convolutional Neural Network, a Machine Learning technique. Using the necessary datasets, the network is trained for the various waste categories. This trained network is linked to a mechanical device that separates garbage physically, eliminating the need for human interaction. The waste items that are fed into this system are classified into their respective types by three fundamental stages:

• Collecting the images of the waste material
• Classification is completed by the Convolutional Neural Network
• A control mechanism is used to perform the physical separation of the trash.

In this project the waste is collected from the water bodies with help of a scooper and is dumped onto the conveyor belt as the waste is passed through a Rpi camera, the image of the waste is captured & is compared with predefined data set and segregated with the help of artificial intelligence into bio-degradable & non-biodegradable bins.

## 2. LITERATURE SURVEY:

**PAPER 1: Lakshmi H R et al., "Smart Bin- Automatic waste segregation and collection", 2018 Second International Conference on Advances in Electronics, Computer and Communications, 9-10 Feb 2018.**

This article outlines a sensible and cost-effective trash segregation system. The suggested Smart Bin is a trash segregation device that separates dry and wet garbage without the need for human interaction and sets the way for timely collection and disposal.

**PAPER 2: Niramon Ruangpayoongsak et al., "A Floating Waste Scooper Robot on Water Surface", 2017 17th International Conference on Control, Automation and Systems,18-21 Oct 2017.**

The Floating Waste Scooper Robot is introduced in this paper (FWSR). The goal of this study is to construct a floating waste scooping robot that can substitute human labor and to analyze the effectiveness of the designed waste scoopers installed on the robot. When using a scooper or changing the conveyor belt speed, waste collection is explored. A scoop net is used to compare the amount of rubbish collected by the robot to human capabilities

**PAPER 3: S.sudha et al., "An automatic classification method for the environment: Friendly Waste Segregation using deep learning", 2016 IEEE Technological Innovations in ICT for Agriculture and Rural Development,15-16 July 2016.**

This paper presents an automated recognition system using a Deep learning algorithm in Artificial Intelligence to classify objects as biodegradable and non-biodegradable, where the system is trained with an initial dataset, can identify objects in real-time, and classify them almost accurately. This system can

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recognize the waste without human intervention based on the material of the item, irrespective of size and shape easily and classify them.

## 3. METHODOLOGY:

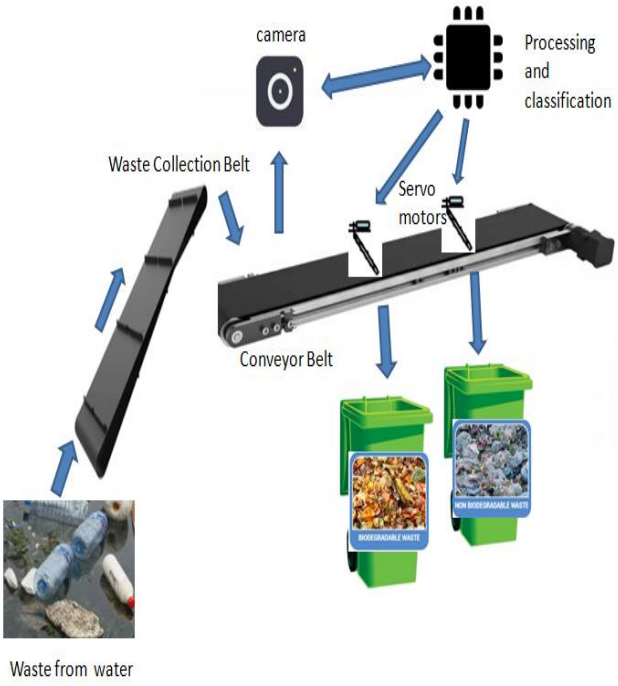


Fig1. The architecture of proposed system

The system consists of a rectangular floating structure, the floating is provided with polyethylene foam placed at the bottom which can float the entire structure more flexibly while navigating through water. The gadget will be propelled by two custom-made propellers that will be powered by a 12V DC acid battery. The propellers will be situated one on each side of the structure and at the structure's central axis, providing more flexibility while navigating. On the front side of the system waste, the collection belt is located by means of links and driven by a motor. The waste accumulation and disposal of the same will be done by the waste collection belt. The belt will collect the wastes from the water and dumps them onto the main conveyor belt. The entire system can be operated by a Bluetooth controller, allowing the operator to clean from a safe location on land. Once the waste is collected by the waste collection belt it is dumped onto the main conveyor belt. The conveyor belt is moved with the help of a 60rpm dc motor with the supply of a 12V battery. As the waste passes through the Rpi camera, the camera processes the image. The input image is compared with the predefined database. The database is created with a different set of images of biodegradable and non-biodegradable google images of size 224X224 using the teachable machine. The comparison of the input image with the database takes place with the help of CNN (convolution neural network). The AI technology identifies the type of waste and if it is biodegradable it is dumped into bin1 & into bin2 if it is non-biodegradable with the help of metallic gear servo motors. The whole system is under the control of Raspberry Pi 3 B+.

### 3.1HOW ARTIFICIAL INTELLIGENCE WORKS:

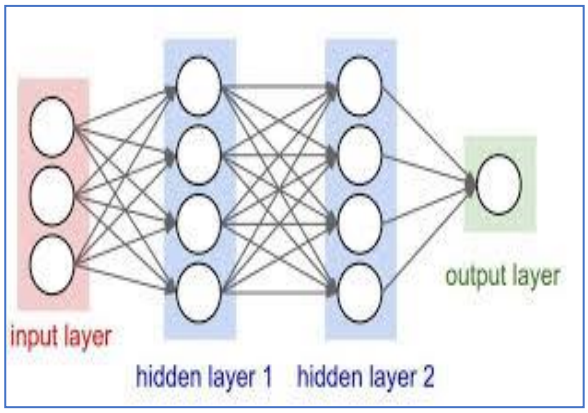


Fig2. Segregation of waste using CNN.

The Three Layers of CNN:

Layer 1:

Convolutional Layer: Convolutional Layer: The first layer to extract information from an input image is convolution. Convolution keeps the connection between pixels by learning visual qualities with small squares of incoming data. It's a mathematical operation using two inputs, such as an image matrix.

Layer 2:

Pooling layer: When the photos are too huge, the pooling layers portion would lower the number of parameters. Spatial pooling, also known as subsampling or down sampling, decreases the dimensionality of each map while retaining the most critical data.

Layer 3:

Fully Connected Layer: In the layer, we call the FC layer, we flattened our matrix into a vector and feed it into a fully connected layer like a neural network. The feature map matrix will be transformed into a vector (x1, x2, x3, …). We integrated these features to generate a model using the fully connected layers. Finally, we have an activation function such as SoftMax or sigmoid to classify the outputs as biodegradable and non-biodegradable, etc.

## 4. RESULT:

The following figure represents the hardware model of the project where the waste is collected from the front-end conveyor belt and is dumped onto the main conveyor belt for segregation.

Fig3.Hardware model

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The following screenshots represent the program and the result of the segregation system using artificial intelligence. The first figure represents the detection of biodegradable waste & the second one represents the detection of non-biodegradable waste.

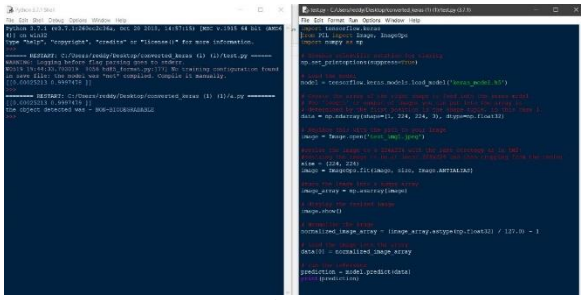

Fig4: Detection of Biodegradable Waste

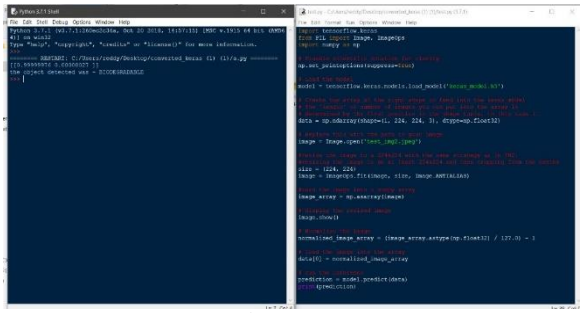

Fig 5: Detection of Non-Biodegradable Waste

## CONCLUSION

Reliable Waste removal can be achieved as the controlling of the system is through a Bluetooth controller and the system operates without difficulty as the system is portable. This system isolates waste automatically utilizing no sensors, however, the energy of the machine figuring out how to perceive which waste can be arranged as degradable and non-degradable. A significant safety level for human beings is achieved as the system itself cleans up the waste without human intervention.

## REFERENCES

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