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MICROCONTROLLER BASED WASTE SEGREGATOR AND MANAGEMENT OF WET WASTE TO PRODUCE ORGANIC FERTILIZER

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ABSTRACT: Industrialization, modernization, rapid advancements and increase in population have led to large generation of waste. It is possible to reuse and recycle the waste effectively by segregation. This paper, proposes an prototype model forwaste separator, which is used to separate the dumped waste spontaneously, leads to the production of fertilizer from food waste recycling. The smart-bin is programmed to give the information aboutandumped waste, so that the respective action would be-taken. Many motors& sensors both are interfaced with the Arduino-board in the system [5]. The smart-bin is divided into 3 sections. Everysection has itsrespective function and waste is segregated into dry, metaland wet waste. The research aims to produce organic fertilizer through providing the suitable environment to decompose the wet waste in to Organic Fertilizer.
Keywords: Arduino, Segregation, Organic Fertilizer

1. Introduction

The existence of food-waste in largeamount has attracted multiple attentions and also it creates more worries. Large quantity of food waste leads to energy loss than lossesin the chain occurring earlier and it has many negative impacts,environmentaland economic impacts.Hence, reducing the amount of food waste into fertilizer is likely to be the best way to overcome the problems. The world has recognized food waste as an additional material in the production of fertilizer, which give benefits to the environment, economy and social vitality complies. Treating of food waste has become one of the most important problems that must be addressed in the future development.

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At present, the collection, transport, and treatment of urban cast food and other waste are primarily implemented by municipality as a public service. Moreover, its treatment technique and methods are based mainly on landfills [6]. Therefore, the level of recovery of resources, utilization of energy and the quantity of food wastage is less due to harmless treatment.This research investigates the recycle of food waste technologies and its practical application. The results demonstrate that food waste treatment should focus on its generation reduction from the source by recycle process. At the same time, an integrated waste management from the waste generation, collection, transport to the latest treatment must be implemented. Rubbish or Trash: 'Is anundesirable or excess of materialwhich is difficult to recogniseexactly what waste is because the things which are considered as waste by some people will be considered as valuable byothers'. Waste Management is something that manages control of collection and comfortable treatment of waste in an easy and also in lowcost ways. The idea is to minimise the harmful effects caused by waste on the society, environmentand also on public health [6].

Many People have studied and implemented ideas on recycling of wastage to produce fertilizer and analyzing the subject importance from different sources. It has been identified through an analysis conducted on the domestic recycling refuse usage of ordinary-water as the source for moisturization. The organic-manure, is an essential substance which will be added only once in a year to the soil, when the mineral-fertilizers are added multiple times, which will reduce the soil enhancers & ability after comparing it with the latter. Some has identified the very important variables, factors which affect the fertilizer composition speed including temperature, microorganisms, surface area and humidity. And it was identified that organisms like bacteria which was found in organic-materials, carbon-food & nitrogen in order to produce reproduction and to generate energy. It was identified that temperature is directly proportion to decomposition and the production of fertilizer that is higher the temperature increase the rate of decomposition & also production of a fertilizer, and decrease the temperature, lower the rate of decomposition & the production of fertilizer. And the air-temperature outside during summer has an impact with the external high temperature in the atmosphere, the speed of fertilizer formation stimulated by the activity of the bacteria. Usually it takes more time during cold weather. In reference to humidity, it has been identified that the bacteria require water for moisturize if humidity is < 40 % and activity of the bacteria reduces when the humidity is > 60 % and in air gaps water replace the air. Hence, the aerobic-bacteria die & anaerobic-bacteria will be activated, which destroys the organic-matter, but slowly generates un-pleasant aroma [6].

The apparatus is a metabolism system which contains microorganisms in order to break down the organic waste in to fertilizer and the resultant product can be used

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in a low energy greenhouse which helps to produce good quality of food crops. The main aim of this system is that the domestic food waste decomposition which compose around 50% of the waste that we dispose every day. And also different daily waste such as kitchen waste rotten fruits, rotten vegetables, garden waste and also white wood compost by using normal house hold water & domestic waste water as the source of moisten for a extraction of organic compost as a result of the biological decomposition of the organic matter by the bacteria with few useful micro-organisms that use nitrogen and carbon in order to produce energy to compose the protein required to enhance their body & also multiply in certain circumstances such as environmental conditions of the warmth, ventilation & humidity [6]. Figure 1 shows the waste (kitchen waste) which should be treated and convert into compost.

Fig.1waste

Each waste contains different pH level where it can affect the plants when formed as the fertilizer. The pH level required for the growth of plant is shown below table-1.

Soil pH	Plant Growth
> 8.3	Too alkaline for most plants
7.5	Iron availability becomes a problem on alkaline soils
7.2	6.8 to 7.2 – near neutral 6.0 to 7.5 – acceptable for most plants
7.0	
6.8	
6.0	
5.5	Reduced soil microbial activity
< 4.6	Too acid for most plants

Table-1: pH level required for plant growth

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2.LITERATURE REVIEW

Currently, there is no system at the household level for separation of organic wastes into wet-waste, dry waste & metallic wastes. But the AWS (Automated Waste Segregator) can be utilized so that the organic waste can be sent for processing directly. This AWS implements inductive sensors to recognize capacitive sensors and metallic items to differentiate between dry-waste and wet-waste based on threshold values that we set. Anyhow, waste can not separate ceramic in-to dry waste as it contains the higher relative di-electric constant compared to other dry wastes which are already classified. By maximizing overall efficiency and accuracy of the system, noise can be eliminated [1].

The draw backs of the system: It can classify only one kind of waste at an instance with a given priority for metal, dry waste and wet waste. Hence, buffer spaces can be utilized to separate different types of waste. As the time, it requires for recognizing metal objects is lesser than the entire recognizing module can be placed along with single platform in which the object is stable in order to ensure better outcome [1].

3. METHODOLOGY

The Smart bin is divided into 3 sections. Every section has its function. The 1st section consists IR-sensor & metal-detector. The 2nd section consists, one more IR-sensor to detect dry-waste & wet-waste. The last section is further divded into 3 different waste collection bins respectively. Entire system is governed by Arduino Mega Board. Arduino board is interfaced with the each and every part [5]. The required code to control the sensors and motors has been coded using Embedded-c language, allowing easy description if the input and output ports. We use IDE-compiler in this project to compile a code and upload using an A-B wire to the board. We use Liquid Crystal Display (LCD) to view the decisions taken by Arduino-processor to provide information of each display. The process of waste decomposition is controlled by making environmental condition optimum for the waste decomposers, the microorganisms uses carbon as an energy source present in the waste and nitrogen for the synthesis of proteins, carbon and nitrogen ratio maintained is 60:30, moisture content present in the waste influence in the waste composting process and enhances the metabolic functions of the decomposers. Desirable temperature is maintained to eliminate pathogenic organism and to support favorable decomposing organism, temperature between 50-60℃ with ideal being 60℃ Preferred, Aeration for sufficient oxygen is controlled for aerobes growth and to block anaerobes growth. The enzyme produced by the aerobes decomposes the organic matter and fertilizer is formed [3].

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4. SYSTEM FLOW

The automatic segregation cycle begins with the identification of waste in the first section, where there is a metal detectors and IR sensor (fig.2). The IR-sensor, is used for detecting the waste presence in the section and separation process begins. If the IR-sensor senses the waste, the metal-detector becomes active & verifies whether, the waste consists the metal [1].

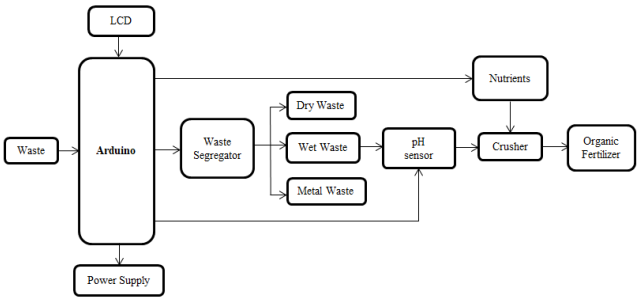

Fig. 2 Block Diagram

The block diagram is shown in figure 2. The magnetic-field, around it includes current in a metal-object, when some metal object is placed near the metal sensor there by causing a loss & increasing the electric-field. If a metal is detected the material is sent directly to the storage section in the first section, where 3 different bins are there for wet waste, metal waste and dry waste. When the 1st sections content are considered non metallic, they are moved to the 2nd section, where the waste presence is checked using an IR sensor (fig.2). The moisture sensor becomes active when the waste is detected in the 2nd section and it is used for determining whether acontentis to be dry/wet, a decision is done using di-electric constant attraction. Higher permittivity means the waste contains water content and thus called wet waste. The contents are moved to the respective bin based on a decision taken by an moisture-sensor. The storage section consists of a 3-bin rotating table, such as wet, metal and dry. The rotating table rotates to a default location according to type of waste identify in the preceding sections for collecting a waste & after waste resets are collected it is programmed by delay (time to rotate a table) [2].

5. BLOCK DIAGRAM DISCRIPTION

IR Sensor: Infra-red sensors (IR) is used to detect the presence of garbage and compartments there are 2 types of detector i.e., Thermal detector and Photonic detector. Thermal detector of the incident IR radiation can flow through many temperatures' dependent phenomenon. Th IR sensor is shown in the figure 3.

Both thermo-couple and thermo-piles use thermo-electric effect. Go lay cells follow thermal expansion. When the object is sensed by the sensor, the micro-

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controller gets turned ON. Wet waste has high di-electric constant compare to dry waste. Capacitance of wet-waste is also more compare to dry-waste. As the capacitance changes the resistance also changes. The change in resistance above the threshold value is used to differentiate the wet-waste & dry-waste [1].

Fig. 3 IR Sensor

Metal detection: It is used to sense the presence of metal in the garbage compartment. When the current passes through the metallic object the magnetic field will be created which indicates the presence of metal particles. The sensible sends the information to micro-controller. Therefore, all the metal particles will be dumped to the metal compartment.

Motor Driver: L293d dual driver kit used in this project is an H-bridge motor-driver IC, which is interfaced with 12V DC motor. H-bridge driver circuit is used to run the motor in both clockwise as well as anti-clockwise direction and it is used to crush the wet-waste. The motor driver pin description is shown in the below figure (fig.4).

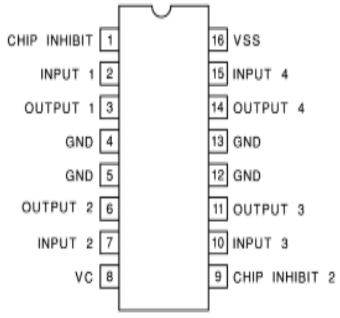

Fig.4 Pin description of dual L293D H-Bridge motor

Arduino UNO: It's a micro-controller board based on ATmega328. It consists of 14 digital i/p & o/p pins, 6 analog i/p, usb connection, 16 MHz ceramic-resonator, ICSP header, power-jack & reset-button. It contains everything needs for the support of micro-controller. To start connect this to computer tousbcable or power this with AC-to-DC adapter/battery. From all preceding boards the uno differs. It

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will not use FTDI usb to serial-driver chip. It features the Atmega16U2 program as usb to serial-converter. The Arduino uno board is shown in figure 5 [5].

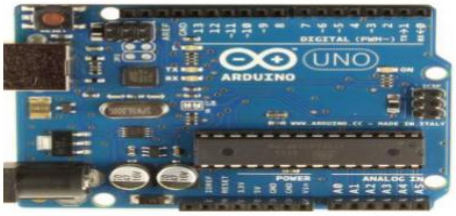

Fig. 5 Arduino UNO R3

pH controller: It is used to measure the alkaline content present in the wet waste according to the table-1. If the pH level is within the permissible value the crushed waste will be utilized as a organic fertilizer. If the pH is more it indicates the presence of more calcium and magnesium which will harm the soil. pH level will be neutralized by oxidizing the wet waste.

LCD: Figure 6 shows the pin and display of LCD. 16X2 display consists of 2 rows of display with 16 pin and operates with 5v supply. In our project once the waste items are segregated it will be displayed on the LCD and even it is used to display the pH level present in the waste.

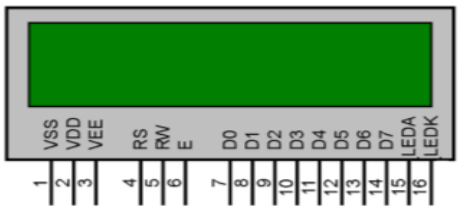

Fig 6 Liquid Crystal Display

6. RESULTS AND DISCUSSIONS

We, have applied the practical scenarios in which a smart-bin has been operated. The result shows an operation of a smart-bin which classifies organic waste and it converts the wet waste into a compost. Phosphorus, Potassium and Nitrogen are the three chemicals used in compost formation. Plants require these 3 macro-nutrients in order to grow large. Nitrogen helps in the growth of foliage, when potassium and phosphorus help in the growth of stems, strong roots, fruits and flowers. All these chemicals have been added to the organic waste using the required pH level in the conversion process. Hence the waste will be converted into fertilizer in 48days as shown in figure 7 [4].

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Fig 7: Fertilizer

Nutrient profile of Compost

S. No.	Parameters	Quantity
1.	Organic matter	70 %
2.	pH	7.5
3.	Organic carbon	33.11%
4.	Nitrogen	0.50 %
5.	Phosphorus	0.15 %
6.	Potassium	0.50 %
7.	Fe (ppm)	1019
8.	Mn (ppm)	111
9.	Cu (ppm)	180
10.	Zn (ppm)	280

Table 2: Nutrient profile of compost

Fig. 8 Working model

Figure 8 shows the overview of this project.

7. CONCLUSION

The principle of recycling organic waste is a successful phenomenon, which has helped to remove around 30 % of waste instead of dumping in the land-fill and [5] becomes a burden for the environment. One of the best alternatives used is natural

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manure for chemical compost available in the presentmarkets and it's no less-useful than acommercial products available [7].

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