Automated wet waste composting system for wet waste material

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ABSTRACT

Composting is the acceleration of the natural process of breakdown of the organic material into a more stable organic substance. This paper focuses on the aerobic composting method. In the presence of oxygen, microorganisms consume organic matter and release heat and carbon dioxide; resulting in compost. This document addresses a composting plan and recommendations for AUI. After analyzing the background, the waste stream, the restrictions and the methods that will be used; a composting tumbler has been made in order to convert AUI's organic waste into compost.

Keywords— Wet waste composting, Arduino Uno

1. INTRODUCTION

Waste Management plays an important role in both generations of revenue and to keep the city clean. Individual middle-class residents in big cities generate nearly 0.8kg of waste per day. And nearly 60% or more of the daily waste generated in the household is made up of organic matter. Compositing is the best way to handle food waste. Our main objective has been to contribute to a project that will result in an improvement of both environmental and human quality. The end product has to be durable and long lasting in terms of function, aesthetics, and construction. Objective of this system is to compose wet waste at home or in tree plant and used as organic manure. All biological treatment technologies applied to the wet (organic) waste treatment would require segregation of biodegradable and non- biodegradable components. Today solid waste management is one of the biggest problems in the world. Around 50% of the waste in the world is an organic waste. India is the second largest populated country in the world; it produces more than100 tons of solid waste a day. It is the mixture of both organic food waste and inorganic waste. Around 78% is food waste, which can be recycled. Some of them are landfilled but it is not segregated properly and it mixes organic and inorganic waste, which produces bad odour, and it will spoil the soil. To manage the solid waste, it should be properly segregated at the source (houses). The organic and inorganic waste needs to be separated, the organic waste can be treated to make compost, and inorganic waste can be segregated and given for garbage collection.

There are many companies who take in the waste and segregate and convert the organic waste into compost but as the waste is very high; they are unable to achieve all the targets so it is better to compost at home. Compost is rich in nutrients. It is used in small gardens, agriculture, rooftop farming, etc. The compost itself is beneficial for the land in many ways, such as soil conditioner, fertilizer, addition of vital nutrients to the soil and as a natural pesticide/insecticide for soil. In ecosystems, compost is useful for controlling soil erosion, land and stream reclamation, wetland construction and as landfill cover. Compost is commonly known as Black gold by gardeners. Anaerobic compost results in the black colour of the soil due to the presence of methane. Aerobic composting results in the dark brown colour chocolate colour of the soil after composting. Compost is organic matter decomposed as fertilizer. Compost is the key to organic farming. The process of composting requires wet organic matter known as green waste (leaves, food waste) and waiting to breakdown into humus for a certain period. Modern methodical composting is a multi-step, closely monitored process with measured inputs of water, air, carbon, and nitrogen-rich materials. The decomposition process is carried out by shredding the plant matter, adding the right amount of water and ensuring proper aeration by regularly turning the mixture.

2. PROPOSED WORK

2.1 Composting process

Vegetable waste is chopped to increase the area of decomposition with the help of cutting blade setup. Addition of compost starter consisting of microbes which starts the composting process. A continuous mixture of the vegetable waste and the compost starter powder for effective composting

with the help of mixing setup consists of dc motor. Use of a natural air filter for avoiding the foul smell and to avoid insects. Use of calcium oxide with the compost starter mixture to maintain the initial heat and to start the composting process.
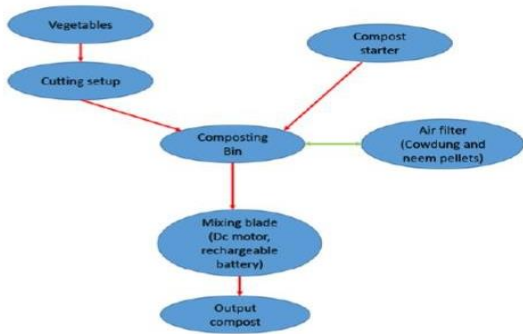

Fig. 1: Flow Chart

2.2 Components used

2.2.1. Moisture sensor: This is an easy to use digital soil moisture sensor. Just insert the sensor in the soil and it can measure moisture or water level content in it. It gives a digital output of 5V when the moisture level is high and 0V when the moisture level is low in the soil. The sensor includes a potentiometer to set the desired moisture threshold. When the sensor measures more moisture than the set threshold, the digital output goes high and an LED indicates the output. When the moisture in the soil is less than the set threshold, the output remains low. The digital output can be connected to a microcontroller to sense the moisture level. The sensor also outputs an analog output which can be connected to the ADC of a microcontroller to get the exact moisture level in the soil. This sensor is great for making water gardening projects, water sensing, etc.
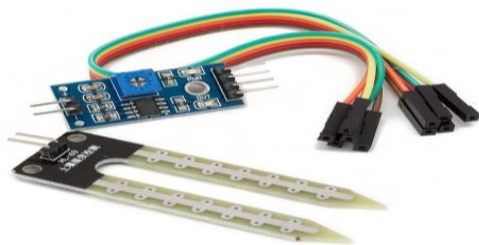

Fig. 2: Moisture Sensor

2.2.2. MSP430: The MSP430 is a blended flag microcontroller family from Texas Instruments. Worked around a 16-bit CPU, the MSP430 is intended for ease and, explicitly, low power consumption inserted applications. The MSP430 can be utilized for low fueled inserted gadgets. The current attracted inactive mode can be under 1 µA. The best CPU speed is 25 MHz. It very well may be throttled back for lower control utilization. The MSP430 likewise utilizes six diverse low-control modes, which can incapacitate unneeded timekeepers and CPU. Furthermore, the MSP430 is fit for wake-up times underneath 1 microsecond, permitting the microcontroller to remain in rest mode longer, limiting its normal current utilization.
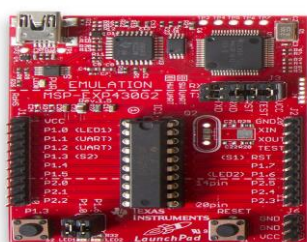

Fig. 3: MSP430 Launchpad

Table 1: MSP430 Specifications

Supply Voltage	1.8-3.6V
Flash Memory	16KB
RAM	512B
Clock Frequency	16MHz

2.2.3. ESP8266: The ESP8266 is a minimal effort Wi-Fi microchip with full TCP/IP stack and microcontroller capacity created by Shanghai-based Chinese maker Espressif Systems. The ESP8266EX microcontroller coordinates a Tensilica L106 32-bit RISC processor, which accomplishes additional low power utilization and achieves a most extreme clock speed of 160 MHz The Real-Time Operating System (RTOS) and Wi-Fi stack permit about 80% of the preparing capacity to be accessible for client application programming and advancement.
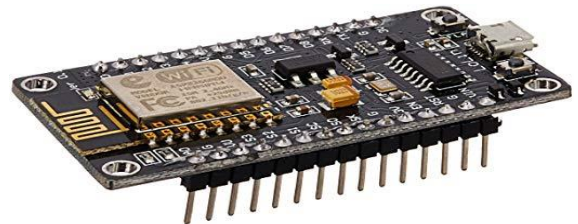

Fig. 4: ESP8266

Table 2: ESP8266 Specifications

Operating Voltage	3.3V
Digital I/O Pins	12
Analog Input Pins	1
Clock Speed	80MHz/160MHz

2.2.4. DHT 11 Temperature and Humidity Sensor: DHT11 is a Humidity and Temperature Sensor, which generates a calibrated digital output. DHT11 can be interfaced with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results. DHT11 is a low-cost humidity and temperature sensor which provides high reliability and long term stability. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and outputs a digital signal on the data pin (no analog input pins needed). It's very simple to use, and libraries and sample codes are available for Arduino and Raspberry Pi. This module makes it easy to connect the DHT11 sensor to an Arduino or microcontroller as includes the pull-up resistor required to use the sensor. Only three connections are required to be made to use the sensor - Vcc, Gnd, and Output. It has high reliability and excellent long-term stability, thanks to the exclusive digital signal acquisition technique and temperature & humidity sensing technology.

Fig. 5: DHT 11 Sensor

2.2.5. DC Motor: DC Motor – 300RPM – 12Volts geared motors are generally a simple DC motor with a gearbox attached to it. This can be used in all-terrain robots and a variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly. 300 RPM 12V DC geared motors widely use for robotics applications. Very easy to use and available in a standard size. Also, you don't have to spend a lot of money to control motors with an Arduino or compatible board. The most popular L298N H-bridge module

with onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC or you can choose the most precise motor diver module from the wide range available in our Motor diver's category as per your specific requirements. Nut and threads on the shaft to easily connect and internally threaded shaft for easily connecting it to the wheel. DC Geared motors with robust metal gearbox for heavy-duty applications, available in the wide RPM range and ideally suited for robotics and industrial applications. Very easy to use and available in a standard size. Nut and threads on the shaft to easily connect and internally threaded shaft for easily connecting it to the wheel.
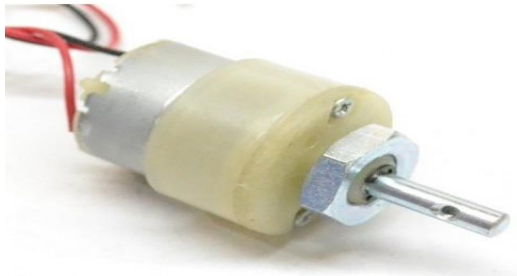

Fig. 6: DC Motor

3. SCOPE OF THE PROJECT
The project scope will be comprehensive focusing on how we can compost our daily dustbin wet waste into organic manure. This project has certain limitation it cannot able to compost plastic wrapper or material which are difficult to compost easily that we cannot be used in this project. So the only material which can be easily composted include leftover food, decay food wasted or a while cutting vegetable there is the unused part which is not required in preparing the meal they are thrown in the dustbin that can be used to prepare organic manure.

4. BLOCK DIAGRAM
4.1. As shown in figure 3 the wet waste is first crushed on crushing unit with the help of Sharpe blade which is rotated by a motor.
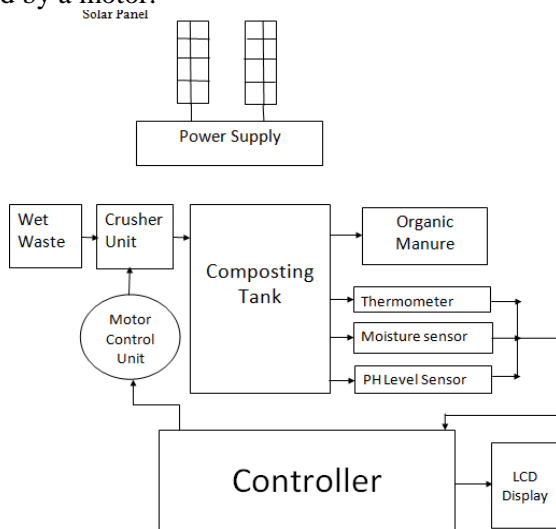

Fig. 7: Block Diagram

4.2. After this process, the crushed material is passed in the composting tank, which is consist of a metal part.

The composting and maturation processes take place in tanks with a depth and width of one meter. The length of the tanks may vary according to what suits the area best. The method used is vermicomposting, where worms and microbes transform the household waste into mature compost.

4.3. Different sensors are fit inside the tank to maintain proper temperature level and moisture to compost waste quickly.

4.4. This reading is displayed on the LCD screen fit on outside of the tank. The controller is used to controlling the speed of the motor and on and off after some time. It is also used to sense all the parameter using a sensor and display on LCD.

5. FUTURE WORK
Wheels can be added at the base so that it is easily transportable. Blade setup can be made with multiple sizes for thick and thin vegetables. Also, dry waste material can be included for composting. Apart from organic manure, we can make Biogas or Biofuel. Blade setup can be removable. Composting area to be transparent. Proper handle for movement of the compost bin.

6. ACKNOWLEDGMENT

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