Design & Development of Solar Powered Compost Bin using Low Cost Automation

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Abstract— **The waste management is very important thing or task to control and reduce amount of waste. And composting has been acknowledged as a main stay for the proper waste management. There are compost bins and that are worked on electricity. But the only problem we might face is its cost and increase in electricity bills. The aim of this project is to enhance the interactivity in household levels by making it easier and cheaper and enabling the user to interact with it as well as making the entire process user friendly. The 'Solar Powered Compost Bin' will be definitely a great work gor proper waste management at houses. And the parameters like temperature, humidity as well as moisture are also controlled. The problem of increased in electricity bills is overcome, as this compost bin is totally worked on solar power supply. Also the 'Solar Powered Compost Bin' will enhance the public health as well as health of soil.**

Keywords— *Composting, electricity, enhance, interactivity, waste management, temperature, humidity, moisture.*

I. INTRODUCTION

In our daily life, there are various ways from which number of waste generates. Every year million tones of waste generates because of various types of reasons. The waste generally includes solid waste, kitchen waste and agriculture waste. So, out of these all wastes solid waste management is one of the biggest problem compare to others. And we know because of increase in volume of waste, the pollution is also increasing day by day which very badly affects on human's health. So, it is necessary to control and reduce the amount of waste. The best way we can start with is nothing but the composting process to reduce the volume of waste. The solid waste management can be done with composting in a better and proper manner. In this solid waste, an organic waste and an inorganic waste are present. The waste which can be recycled and can be made compost of it like food waste is called as an organic waste. And the waste which can be collected for garbage after segregating it, is an organic waste.

The main objective of the project is to do a comparative study of compost bins working on electricity which are mostly used at industrial levels. The original idea is to use solar energy instead of electricity and make it user friendly and cheap to enhance the interaction with composting for each person at a household levels.

In our country, amount of organic waste is greater out of the total waste. So, disposing of biodegradable that is organic waste at houses can create better impact in the domain of waste disposal.

II. LITERATURE REVIEW

NehaMahuli et al [1] . designed a system to segregate the waste such as dry waste, wet waste and metallic waste. The ' Solar Powered Waste Segregation System ' is designed with mechanical structure using some mathematical calculations. In this framework is done using frames, DC motors, DC gear motors.

Aeslina Abdul Kadir, Nur W.A. and Siti Noratifah J. et al [2]. discussed details about percentage of organic waste in Malaysia and global issues because of that. It provided an overview of an organic waste in composting. Also reviewed studies on process of composting of biodegradable that is organic wastes also states it's classification.
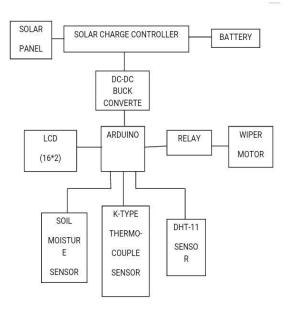
Saleh Ali Tweib, Rajni A.R. and Mohd Sahail K. et al [3] . reviewed studies of composting whose aim is to stabilize the waste in various applications like landfilling as well as helps to reduce solid waste. This concerns the environmental pollution, also provides information about composting for managing waste properly. The detailed outline about why composting, fundamental types of composting, phases of composting, important **parameters** of composting process. The methods of composting, which materials are suitable for composting and use of compost also discussed here in better way.

ModupeStelaAyilara, Oluwaseyi S.O., Olubukola O.B. and OluOdeyemi et al [4].discussed proper waste management through composting. Various methods are available of waste disposal. This lead to use composting over all other conventional methods for waste management. Also discussed about ' How are we affected by wastes and How should we treat it ? '. It provided detailed information about effects of wastes, classification of wastes according to biodegradability and methods for composting also.

III.   PROPOSED SYSTEM

Block Diagram for 'Solar Powered Compost Bin' is shown in figure 1.

Figure1. Block Diagram for Solar Powered Compost Bin

3.1 Solar Panel

Loom Solar 50 watt mono panels are made of A grade mono perk cells and ultra cleared tempered glasses that does not break easily and gives 22% higher efficiency even in low light and cloudy weather. Loom solar is only company in india that makes mono panels using perk cells in 12 volt design. The additional feature includes 4 busbars, 36 cells and 25 years performance warranty. IP 67 rated junction box is given with MC4 compatible cable connector for higher module efficiency.

3.2 Solar Charge Controller

It is a PWM 10A Solar Charge Controller 12V 24V LCD Display Dual USB Solar Panel controller. 1x Solar panels Battery Charge Controller With Timer and light sensor, it could work for solar light system. Only for off-grid PV Solar System. For 10A 12V Pv System: 120W Solar Panel, 12V Lead-acid Battery, 21V for Max input voltage For 10A 24V Pv System: 240W Solar Panel,24V Lead-acid Battery,42V for Max input voltage.

3.3 Battery

The rechargeable batteries are lead-lead dioxide systems. The dilute sulfuric acid electrolyte is absorbed by separators and plates and thus immobilized. Should the battery be accidentally overcharged producing hydrogen and oxygen, special oneway valves allow the gases to escape thus avoiding excessive pressure build-up. Otherwise, the battery is completely sealed and is, therefore, maintenance-free, leak proof and usable in any position.

3.4 DC-DC Buck Converter

It is a DC-DC Step Down LM2596 (Peak 3A) Adjustable Voltage Regulator Module Buck Converter. The LM2596 regulator is monolithic integrated circuit ideally suited for easy and convenient design of a step−down switching regulator (buck converter). It is capable of driving a 3.0 A load with excellent line and load regulation. This device is available in adjustable output version and it is internally compensated to minimize the number of external components to simplify the power supply design.

3.5 Liquid Crystal Display (LCD)

This is I2C interface 16x2 LCD display module, a high-quality 2 line 16 character LCD module with on-board contrast control adjustment, backlight and I2C communication interface. For Arduino beginners, no more cumbersome and complex LCD driver circuit connection. The real significance advantages of this I2C Serial LCD module will simplify the circuit connection, save some I/O pins on Arduino board, simplified firmware development with widely available Arduino library.

3.6 Arduino

The ARDUINO NANO is used here for automation through which all processes are controlled in this system. It is a V2.2 arduino nano 30 pin IC.

3.7 Relay

Switching capacity available by 10A in spite of small size design for high density P.C. board mounting technique. UL, CUL, TUV recognized. Selection of plastic material for high temperature and

better chemical solution performance. Sealed types available. Simple relay magnetic circuit to meet low cost of mass production.

3.8 Wiper Motor

12V 55Rpm DC Wiper Motor - Left is commonly used as wiper motor for cars, but it can also be used in the field vehicles and projects that require high power. The motor speed is 55rpm and because of the bearing used it has no problem with longer operation times. The motor has 6mm screw holes for mounting and its gear is designed to be on left side of the motor.

3.9 Moisture Sensor

This soil moisture sensor measures soil moisture level by capacitive sensing rather than resistive sensing like other sensors on the market. It is made of corrosion resistant material which gives it an excellent service life. Insert it in to the soil around your plants and impress your friends with real-time soil moisture data! This module includes an on-board voltage regulator which gives it an operating voltage range of 3.3 ~ 5.5V. It is perfect for low-voltage MCUs, both 3.3V and 5V. For compatibility with a Raspberry Pi it will need an ADC converter. This sensor is compatible with our 3-pin "Gravity" interface, which can be directly connected to the Gravity I/O expansion shield.

3.10 Temperature Sensor

It is a Cold-Junction-Compensated K-Thermocouple to-Digital Converter (0°C to +1024°C). The MAX6675 performs cold-junction compensation and digitizes the signal from a type-K thermocouple. The data is output in a 12-bit resolution, SPI™-compatible, read-only format. This converter resolves temperatures to 0.25°C, allows readings as high as +1024°C, and exhibits thermocouple accuracy of 8LSBs for temperatures ranging from 0°C to +700°C. The MAX6675 is available in a small, 8-pin SO package.

3.11 Humidity Sensor

DHT11 digital temperature and humidity sensor is a composite Sensor contains a calibrated digital signal output of the temperature and humidity. Application of a dedicated digital modules collection technology and the temperature and humidity sensing technology, to ensure that the product has high reliability and excellent long-term stability.

IV.   WORKING

- The ARDUINO NANO is used for automation.
- The Liquid Crystal Display (LCD) is used to show the status or value of the temperature, humidity.
- And all energy to all the devices or components is given or provided by the solar panel.
- The motor is placed at the top.
- The shaft is attached to that motor and the blades are also connected to that shaft.

V.   MODEL DESIGN

Figure2. Working Model Design

VI.   CONCLUSION

The proposed system for the degradable waste management as well as degradable waste disposal by using composting have shown feasibility in terms of humification and its use also. As it is easy to use and cost effective, compost bins plays an important role in solid waste management. So, it can be conclude that composting process is always best way as compared to other

conventional waste disposal methods in economy point of view, an environment point of view as well as pollution point of view also. It have successfully implemented. With the help of this proposed system, the volume of waste is largely reduced. It is beneficial system for reducing pollution specially air pollution which is produced by burning of waste, reduce transportation cost also as composting is possible at houses with this system. This system is powered by solar panel and battery, hence reducing environmental pollution and making it sustainable for the future. Finally, it can be conclude that the solid waste management can be properly done with this compost bin by properly making composts of biodegradable waste and making easy to use and cost effective also.

VII. FUTURE SCOPE

- Using number of sensors for detecting waste, the segregation of the waste can be build in with this proposed system.
- Use of this system can be enhanced in big applications by increasing number of solar panels.

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