IOT BASED VERMICOMPOSTING; AUTOMATIC MONITORING AND CONTROL OF VITAL PARAMETERS

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Abstract - The excessive usage of chemical fertilizers in the field of agriculture is one of major contributing factor to the environment deterioration due to the generation of carbon dioxide (CO2) and water resources contamination. This further leads to loss of fertility of the soil and thus impact the agricultural productivity. Also due to intense agricultural activity huge quantities of agricultural waste is generated and it poses the challenge of safe disposal. It is either burnt or even land filled. We can use the nature's inherent ability for converting this organic waste into useful resources. Microorganisms such as earthworms that are present in nature are one of the important biological organisms that assist in maintaining flow of nutrient from one system to other system and reduce environmental degradation. Nowadays it is being realized that it is much essential to adopt the ecological and sustainable framing practices. Vermicomposting is one such the biological technique that uses the earth worms to decompose the organic waste and produce a organic manure. The manure produced from Vermicompost helps in increasing the soil fertility and hence play the foremost role in increasing the agricultural productivity. Various parameters like temperature, moisture, gaseous released need to monitored and maintained for survival of the earthworms and thus accelerating the vermicompost process The drawback of Vermicomposting technique is that the process requires lengthy period varying from 45-120 days depending on the material which is to be composted.. In this project, a prototype system for monitoring and controlling the vital parameters of the vermicompost process is presented. The system is based on the concept of IOT. The system monitors various parameters like temperature, humidity, moisture, level of gases in the chamber and helps in accelerating the process of vermicompost .Thus the time required to produce usable compost can be reduced and it also reduces the load on the human personnel.

Key Words: Aurduino UNO, ESP8266, DHT11, Gas Sensor MQ-5, Soil moisture(FC-28) , ThinkSpeak web server.

1.INTRODUCTION

The use of chemicals is decreasing the soil fertility of the soil and also the potency of the soil. Organic farming is one type of farming which helps in maintaining the soil quality. It depends on ecological processes and biodiversity which are adaptable to local conditions. 'Vermiculture' is one kind of organic farming method .In this method earthworms are artificially grown by providing them adequate environment conditions. The worms feed on cow dung and other farm wastes. Meanwhile as this waste is excreted by the earthworms it gets converted into natural manure known as Vermicompost. This manure can be utilized in agriculture.

A brief survey is presented here. The agriculture waste ,industrial waste or kitchen waste that are produced due to intensification of the agricultural

activities, industrial activities and household activities can be recycled and utilized to reduce the risks posed by improper disposal of these wastes and also utilize the valuable resources that can be obtained from the biomass by employing the composting technique [4]. Burning of crop residues, one of the major factor contributing to the degradation of the air quality and thus posing serious health issues can also be overcome by employing composting technique [5]. The vermicomposting technique using the earthworms can be used to reduce the impact of intense agriculture and industrial activity .It has different advantages viz., enhancement of soil fertility, enhanced crop productivity, increase in the water retainment capability of the soil, promote the growth of plants, reduction of disease causing pathogens [1-4].The vermicomposting process use red wrigglers(Eisen Foetida),require a long period of 45-120 days for conversion of waste into fertilizer. During this entire span the various parameters like temperature, moisture, pH have to maintained at a level that promotes the survival and growth of these worms and thereby maintains the microbial activity of the worms at the optimum [1],[4].

The proposed prototype system has been designed with Arduino UNO & ESP8266 Wifi Module along with the sensors to monitor the moisture, temperature, and detect methane gas liberated in chamber. The various parameters are maintained by using water pump, heater, fan, servo motor. The system monitors and automatically controls the parameters. Also the current stauts of the parameters is transmitted to the ThinkSpeak webserver for the purpose of monitoring.

2. CONCEPTUAL FRAMEWORK

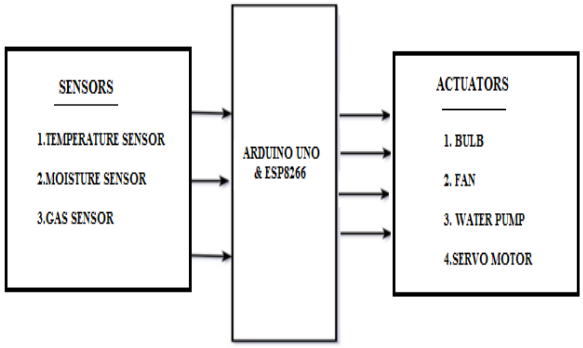

Fig 1: Block diagram of the system

ARDUINO UNO & ESP8266

The system is built around the Arduino UNO , which is acting as the central processor. It takes the various inputs from the sensors (1. temperature sensor, 2. humidity sensor and 3. soil-moisture sensor) connected to it , processes the data as per the embedded program and initiates corrective action as required. The read data values of the temperature, moisture and gas level are also transmitted to the ThingSpeak webs server for purpose of monitoring using the ESP8266 module. The water pump, bulb, fan and servo motor are also connected to the Arduino for initiating required action and controlling various parameters.

SENSORS

Here we are using three sensors: DHT11 sensor , it is a popular Temperature and Humidity sensor.It is used to measure the temperature produced in the vermicomposting chamber. The second sensor is the Soil moisture sensor FC-28; used to measure the soil moisture percentage and the last one is gas sensor MCQ-05 is used to monitor the level of methane gas produced in the vermicomposting chamber.

ACTUATORS

The data collected by the sensors is processed by Arduino UNO and necessary control action is taken so as to keep the essential parameters temperature,

moisture and gas level under by actuating the devices like fan, pump, heater and servo motor.

WEB SERVER

In the proposed system the controlling action is done automatically. In order to communicate the current values of data to the authorized person, the system uses ESP8266, which is wi-fi module to transmit the data to the ThingSpeak Web-server.

3. RESULTS

The Fig 2 shows a snapshot of the hardware setup that is used.

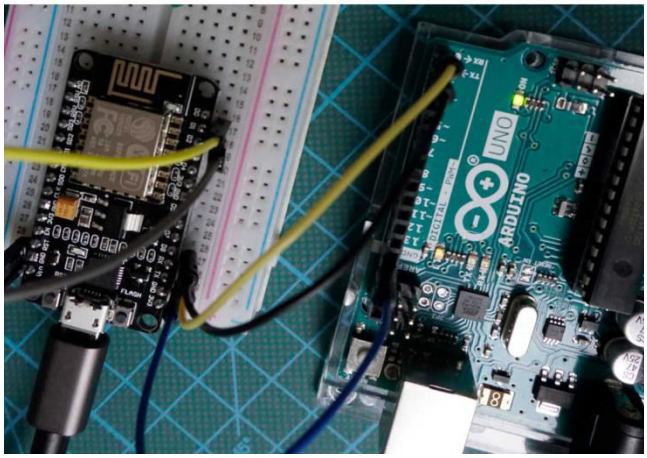

Fig 2. Hardware Setup

The Fig 3. shows a snapshot of the temperature data displayed on the ThingSpeak webserver.

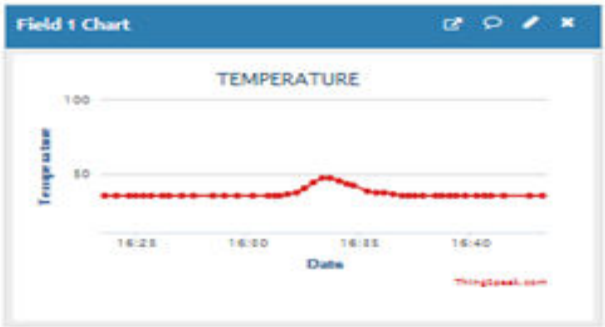

Fig 3. Sample Output on ThingSpeak Webserver

4. CONCLUSION & FUTURE SCOPE

In this proposed system the controlling of parameters like moisture content of the vermicomposting bed , temperature of the vermicomposting chamber and level of gas produced in the chamber which are essential for survival and also growth of the earth worms; which was difficult earlier is now made easy by use of the Arduino Controller. The authorized person can monitor these parameters from anywhere in the world through the Thingspeak webserver. There is scope for improvement by adding the feature of controlling the various parameters through internet.

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