

Smart Vermicomposting Control

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Abstract: Vermicomposting plays an important role in agriculture. It is the organic waste which can be broken down and fragmented rapidly by earthworm. This results in a stable nontoxic material which acts as a solid conditioner for agriculture plant growth. Some important parameters that directly affect the production of that nontoxic material are moisture, temperature, humidity and level. If we can provide a suitable environment to the earthworms by controlling the various parameters that directly affects the growth and production we can expect a very good output for the farmers Earthworms feed the organic waste materials and passes it through digestive system gives out in a cocoons known as vermicomposting. The earth worms come in to the solid materials only at night. These makes holes in the soil surfaces up to a depth of 3.5 meter and produces 5.6 kg casts by ingesting 90% soil and 10% organic waste. Production of the cast can be improves only by controlling the right parameters associated with the composting.

Keywords: Vermicompost, Arduino, Temperature sensor, Humidity sensor, Ultrasonic sensor, Moisture sensor

1. Introduction

Good quality compost production in ambient temperature can be accomplished in shorter time by the process of vermicomposting that involves use of proper species of earthworms. The native cellulase activity of earthworms and microorganisms in earthworm gut promote faster decomposition of ingested organic material. The combined effect of enzymatic activity and grinding of organic materials to fineness by earthworms produces the vermicomposting and this is not observed in compost pits without earthworm. Earthworms weights about 0.5 to 0.6 grams and it eats waste equivalent to its body weight and produces cast equivalent to about 50% of the waste it consumes in a day The moisture content of the casting ranges between 32% and 66% and the PH is about 7. The level of materials in the compost depends upon the source of raw materials and spaces of the earthworms. The temperature is kept between 22 ° to 30 °. It is seen that if the temperature, moisture content, humidity and PH value can be kept in specified limit the production of the composting and its quality improves in a satisfactory manner.

2. Controlling

In this paper, we are controlling the physical parameter of the Vermicompost. We are trying to improve the production of vermin composting with maintaining its physical condition automatically, so that it can help in production without degrading the soil fertility. With the help of Arduino UNO we design the system. With input devices, ultrasonic sensor, temperature and moisture sensor(probes) and humidity sensor (DHT22) used to control and maintain the level(within 10 cm), temperature(in 28°C), moisture and humidity respectively. Solenoid operating valve, water pumps fans will work as output devices which will operate accordingly to the instruction as given in the programming.

3. Components Used

- 1) Micro controller, Arduino UNO
- 2) Soil moisture sensor, Probes,

- 3) Ultra sonic sensor
- 4) Humidity sensor, DHT22
- 5) Pipe (as a sprinkler)
- 6) Solenoid operating valve,
- 7) Fans
- 8) Relay
- 9) Water pump
- 10) Adapter (5 volt. 1amp. , 12 volt. 1 amp.)
- 11) Jumpers
- 12) Connecting wires

4. Circuit Connection with Arduino UNO

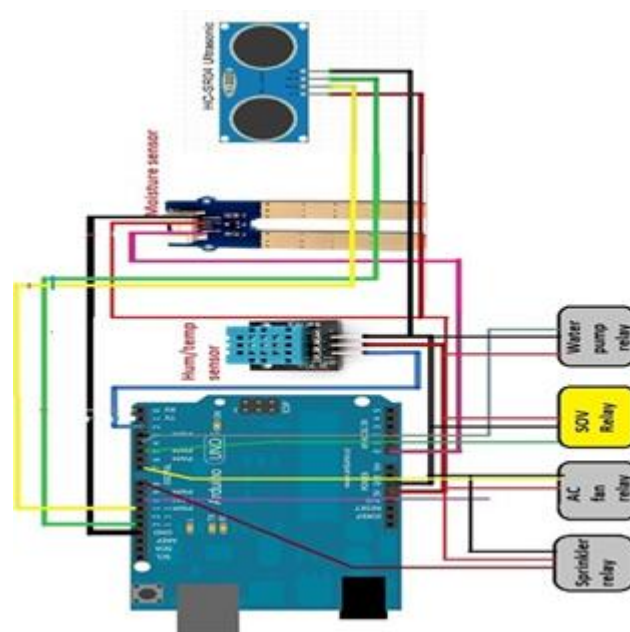


Figure 1: Circuit Connection

This smart vermicomposting controlled device is basically a prototype used for the controlling the parameters of moisture, temperature, humidity and level of the water overhead. The working of the system is as follows-

DC power supplied through adapter to Arduino 5V 12V to solenoid valve, water pump, DC fan and relays. Soil moisture

sensor and humidity sensor is directly connected to the arduino. Water pump, fan and solenoid are connected to the arduino through DC relays. When soil moisture probes senses the moisture below 50%, then sprinkler gets activated and control the moisture of the system. Again, when temperature is more than 28C, then fan gets into action and thus control the system temperature. When the overhead level decreases below 10cm which detected by the ultrasonic sensor then the solenoid valve gets activated and maintains the level. Here, ultrasonic sensor measure 10cm from its transmitter and receiver. When humidity sensor senses humidity below 55% then, sprinklers get activated. All the above actions is controlled by the Arduino which is preprogrammed by us. By this way, our prototype continues its action.

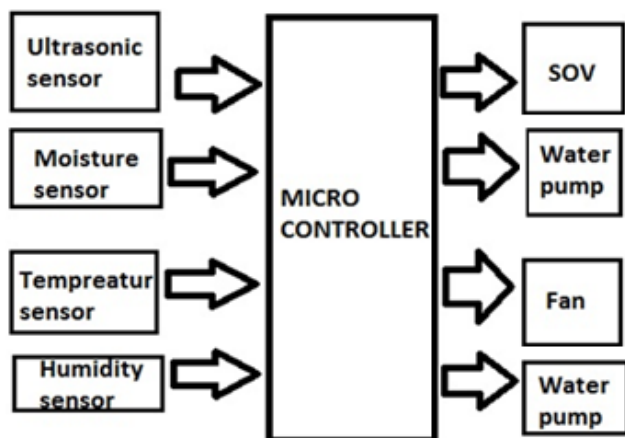


Figure 2: Block Diagram

5. Observation

Table 1: For Level control

S. No.	Level (By ultrasonic sensor) (In cm)	Solenoid valve
1	More than 10cm	OFF
2	10cm	ON
3	Less than 10cm	ON

Table 2: For Temperature control

S. No.	Temperature (By soil moisture sensor) (In °C)	Fan
1.	More than 28°C	ON
2.	Less than 28°C	OFF

Table 3: For moisture control

S. No.	Moisture (By soil moisture sensor) (In %)	Sprinkler
1.	Below 50%	ON
2.	At 50%	OFF
3.	Above 50%	OFF

Table 4: For humidity control

S. No.	Humidity (By humidity sensor) (In %)	Sprinkler
1.	Below 55%	ON
2.	Above 55%	OFF

6. Conclusion

This work on, “SMART VERMICOMPOSTING CONTROLLED DEVICE” is a prototype, which is designed and developed successfully for demonstration purpose. As it is a demo module it cannot be used for real application, but the concept is nearly alike to the real working system which

would create a vast field of possibilities in the upcoming days. In advance level of our prototype, we could build an industry of vermicompost production which would provide immense future possibilities for the people as well as high production rate of crops. With this system, we can produce organic nutrient rich production without degrading the soil quality. Since degradation of soil is one of the most emerging problem which is being faced by us now a days. One of the most crucial advantages of this system is that it does not pollute the environment with any means.

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