

Controlling of Vermicompost Atmosphere By Using Internet of Things (Iot) and Optimal Energy

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Abstract- Utilization of chemical fertilizers is threat to agriculture land as well as environment and humanity. In this scenario all are focussing on organic forming which gives healthier life products and saves ecosystem. In organic forming vermicast is used for best production of crops. Because of rise in temperature, the warms not surviving in compost pit or bin.

A proto type is made in this project for controlling of the vermicompost atmosphere. IoT is incorporated for automation and communication purpose. The required condition is maintained by sensing the required parameter i.e., temperature with usage of temperature sensor. Optimal water source is used with the help of servo controller. GSM module helps to get the warning whenever the temperature crosses the specified limits. This project helps in resulting the best vermicast in higher quantity and with rich nutrients.

Keywords- Vermicompost, Solar Energy, Earth warms, IoT, Optimal energy, GSM modem, Servo motor.

I. INTRODUCTION

Agriculture is an important sector in most of the countries which plays major role in development of Nation. In India 70% of the people depends on the cultivation. As the levels of energy resources declining day by day due to global warming and climate changes, the problems concerning agricultural field have been always hindering the development of the country.

Now a days forming is no more sustainable in many parts of the country because of the environmental degradation, not getting much profits and facing complex weather issues. In forming most of the formers use the synthetic fertilizers (artificial or chemical fertilizers) which are more hazardous to human health. To get good natural food products organic farming is better option but as the cost of the organic compost is high, farming sector still depends on artificial fertilizers even though it is more hazardous to health. The solution for these problems is production of organic fertilizers in higher

quantities and overcoming the difficulties in production of organic fertilizers.

One of the best methods in production of organic fertilizers is vermicomposting. vermicompost production is at very lower quantities because of the global warming. Controlling of vermicompost atmosphere by using IoT and optimal energy is the main aim of this project.

II. THEORY

Vermicompost :

vermicompost is an excellent, nutrient-rich fertilizers made up of organic materials and by earthworms. It is also a good soil conditioner. It is the product of vermicomposting. Vermicomposting is process of composting by using earthworms. Vermicompost is aslo called vermicast, worm manure, worm humus, which is the end product of the breakdown of organic material by earthworms. All organic wastages can be converted in to vermicompost.

According to certain studies the atmosphere temperature plays a vital role in the life cycle of earthworms in turn in the production of vermicompost. Most of the studies say that problems arise due to higher atmospheric temperatures. As temperature goes beyond 30° C soil moisture goes below 60%. Moisture content less than 50% slows decomposition. Moisture percentage level should be maintained above or around 50%. The best fitted breeding time of the worms is between 12-18° Celsius. At this range they can reproduce well and at 15-25° Celsius the decomposing of the worms is at high rate. So, by maintaining the proper temperature the manure can be produced in large scale and efficiently.

An earthworm can ingest around half of its weight every day. For example, if 100 gm of Earth warms are there, 50 gm of feed is needed. The ratio of the earthworms to feed is 2:1. On some average 1000 earthworms will weigh for 1 Kg. When earthworms are less than 1 kg, the amount of feed material can get by simple calculations.

Eisenia foetida are the best suited earthworms and for most vermicomposting processes Eisenia foetida were used in India. These earthworms are also called as red worms, panfish worm, branding worm, manure worm, trout worm, tiger worms. These are adapted for organic material decomposition. The best materials are leaf piles, Vegetable peels and old manure piles.

III. MATERIALS

The main items required for this project:

- Arduino UNO
- GSM Modem
- Solar power storage device
- Servo motor
- Temperature sensor

Arduino:

Arduino is an open-source electronics platform which is user friendly and useful in controlling the output. Simple to use “Open source” electronic hardware that contains Controlling electronic chip (micro controller), Standardized hardware, Connections. Main parts are USB Connector, Power connector, Analog Reference, digital out pins. The Arduino is a next to the simple microcontrollers. The Arduino consist a advanced cerebrum (otherwise called a microcontroller) which can be easily programmed for small application purposes. Arduino can be connected with LEDs, LCDs, engines, Sensors like temperature sensors, moisture sensors, humidity sensors, Light sensors and so on.

Arduino/Genuino UNO is one among many types of Arduino boards. It is also open source hardware and user friendly as it is mentioned previously. This UNO board can be programmed with the help of Arduino software(IDE). We need to select the board by clicking on the Tools and board menu according to microcontroller on the board. Arduino tutorials will be helpful in settings.

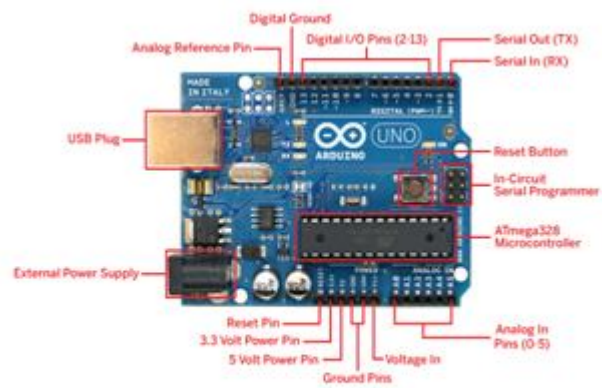


Fig.1 Arduino Uno with its parts descriptions

The ATmega328 is pre-programmed with a bootloader. This bootloader allows us to write and upload new code to it without usage of any external hardware programmer. The communication process takes place by using the STK500 protocol by the reference of C-header files.

SIM900A Modem:



Fig.2 SIM990A modem

SIMCOM made this SIM900A GSM modem. It built with dual band mode. SIM900A modems are GSM/GPRS based modem and these modems work on frequencies 900 or 1800 MHz. There is no manual setting to reach these frequencies by the modem, it can search automatically these two frequencies. We can also set the bands by AT commands. We can set the baud rate between 1200 and 115200 by AT commands. These GSM/GPRS modems have internal TCP/IP stack to enable us to connect internet via GPRS. SIM900A is a reliable and compact wireless module. It is designed with single chip processor integrating AMR926EJ-S core. This is SMT type module. It gives us effective solutions.

Specifications of the used modem:

- Dual band type 900/1800MHz
- GPRS enabled
- GSM Slot for 2G or 3G sims
- AT Commands will be executed by this SIM900A.

- SIMCOM Company
- Voltage ratings: 5Volts
- Min Power consumption: 1.5 mA (in sleep mode)
- Operating temperature range: -40 °C to +85 °C

Servo motor:

A servo motor is an electric device which consist of an output shaft. This output shaft can be controlled by the input signal to the servo motor. The position of the shaft will depend on the input value. We can turn it to an angle by giving a coded signal to servo motor. As much time as the given signal code exist on the input line the angle of the shaft will remain same. Whenever the input coded signal change takes place then the angular position of the output shaft changes according to the input value. The main applications of these servo motors are in radio-controlled aeroplanes to position control surfaces such as elevators and these are also used in remote control cars, toys as well as robots.

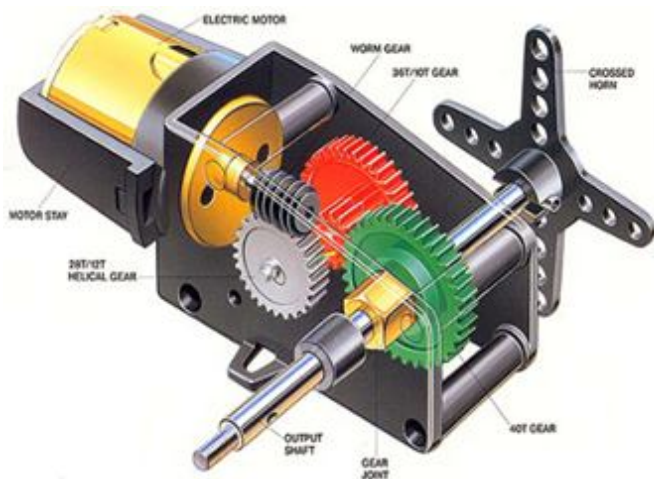


Fig.3 Guts of servo motor

Servo motors are very extensively used in robotics. The servo motors are small in size and are controlled by circuits. They are strong compared to its size, for example a standard servo motor FUTABA S-148 has 42 oz/inch of torque, which is strong compared to its size. It consumes power proportional to the mechanical load. When the load is less on the servo, it does not draw much power from the power source.

The guts of servo are depicted in the figure.3. It consists of electric motor, different gears' set, output shaft and cage. It has three wires one for power (+5 V), the 2nd one is for Controlling and the other is for ground.

Temperature sensor:

LM35 temperature sensor is one type of the IC temperature sensor. It is made up with high precision. The voltage output of the temperature sensor LM35 is directly proportional to the output voltage of the LM35 temperature sensor is linearly proportional to the °C (Celsius) temperature. So, the LM35 has an advantage over other temperature sensors which are calibrated in °K(Kelvin). There is no need to subtract a large constant voltage for converting °K to °C. There is no need of external calibration. Its accuracy at room temperature is ± 0.25 °Centigrade and ± 0.75 °Centigrade for overall temperature range i.e., -55 to 150 °C. These are the cost-effective temperature sensors.

LM35 can be used in a single power source or +/- supplies. It consumes only 60 μ A from power source. Different series in LM35 are LM35A, LM35B, LM35C, LM35D. these are in TO-46 or TO-92 transistor packages.

LED:

LED consist two legs, one +ve and other -ve. LED polarity can be easily find out by observing its legs closely. To find its -ve terminal we have to find which leg is short. The other leg i.e., longer leg is +ve terminal. For the negative terminal side, there will be a flat edge on the bulb portion.

Solar Power Bank:



Fig.4 Solar power bank

Solar panel is used in solar power bank. Solar power bank will be able to store high power and can be used for longer period. This device is simple, light weight and we can get rid of hassle by using this device. We can charge it by keeping it in exposure to sun light. When there is no availability of sun light, it can be charged from wall out power by using adapter. Make sure that it gets charged fully during day time (when sufficient light is available).

IV. METHODS

Controlling of vermicompost atmosphere by using IOT and optimal energy is designed. The arduino is programmed with arduino software(IDE). IOT concept is used for showing the sensed data on display. Controllers are monitored by GSM modem.

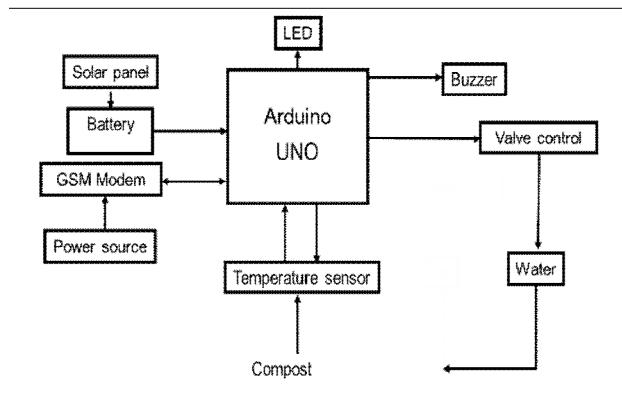


Fig.5 Block diagram of the System

Connect Servo motor, Temperature sensor and Buzzer to Arduino board with jumper wires. Connect the GSM modem with Arduino board. Connect Board with Laptop or Desktop with the help of special USB cable. Make port settings and write Arduino IDE software program and upload it to board.

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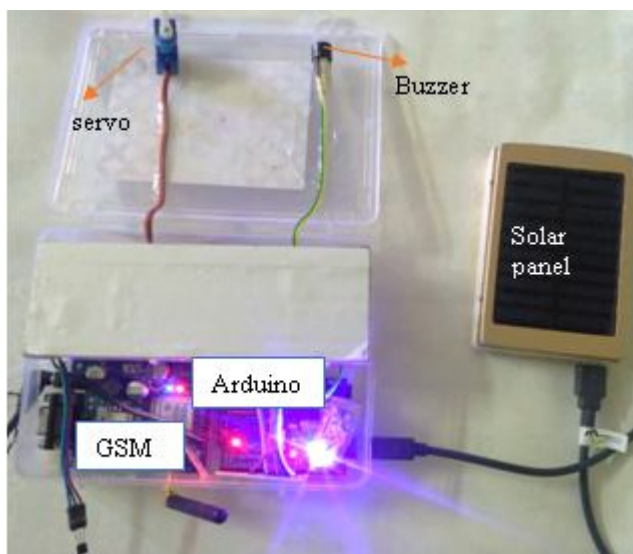
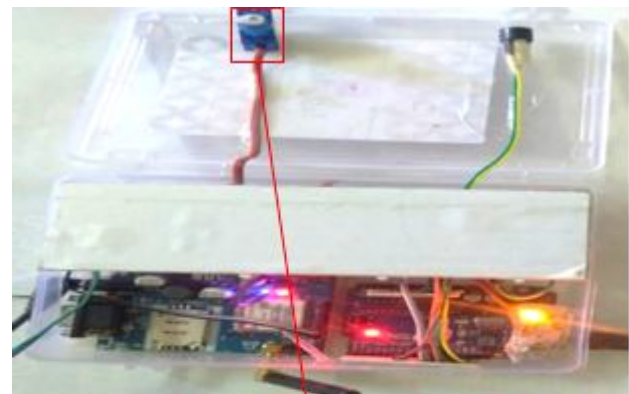


Fig. 6 Image of Proto type of the project.

Prototype of the project controlling of vermicompost atmosphere by using IOT and optimal energy is shown above. Solar power bank is used as a power source which can be charged in dual mode i.e, by solar energy and regular power. Arduino UNO is suitable for this project and this is cost effective board compared to raspberry pi and other IoT devices. 900A GSM modem is used for communication purpose.

V. RESULTS AND DISCUSSIONS

The required atmosphere can be achieved for better production of Vermicompost by this project. As per the desired conditions controlling action will be taken. Temperature data is collected with the help of temperature sensor. Temperature of the Vermicompost is controlled. Water tap will be opened. When the temperature rises above the set temperature. If the rise of the temperature is little, then the valve will be opened partially and when the temperature rise is high the valve will be opened fully. This valve is controlled by servo motor. The degree of valve opening will depend on the degree of temperature rise. If the temperature goes above the upper limit a phone call will be sent to registered mobile number.



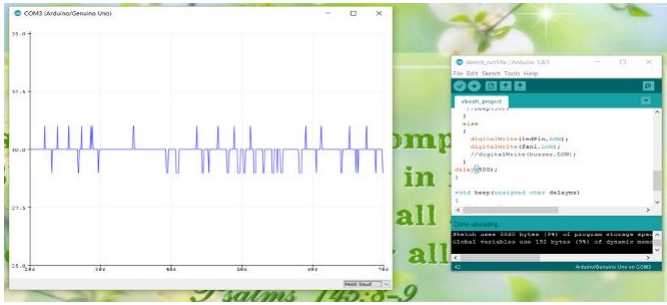


Fig.7 Temperature data in Arduino serial plotter screen.

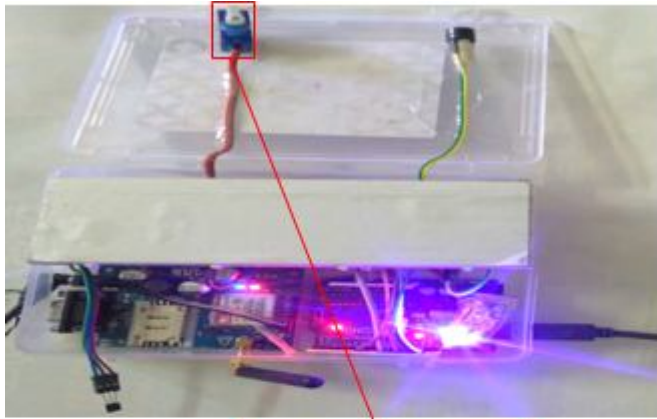


Fig.8 Servo position at temperature within the limits.

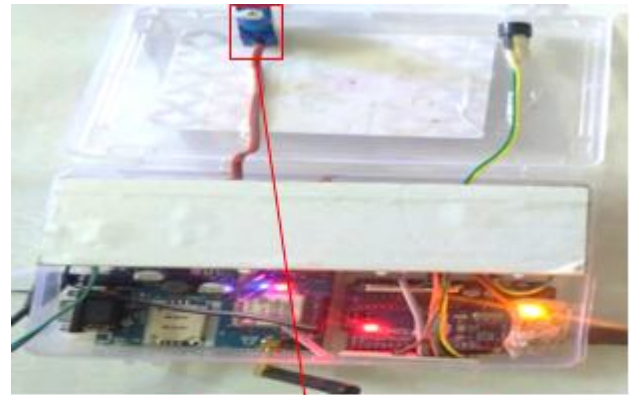


Fig.9 Servo position at temperature beyond the limit.

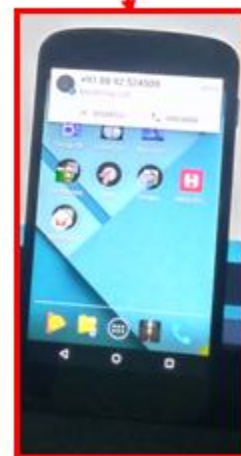
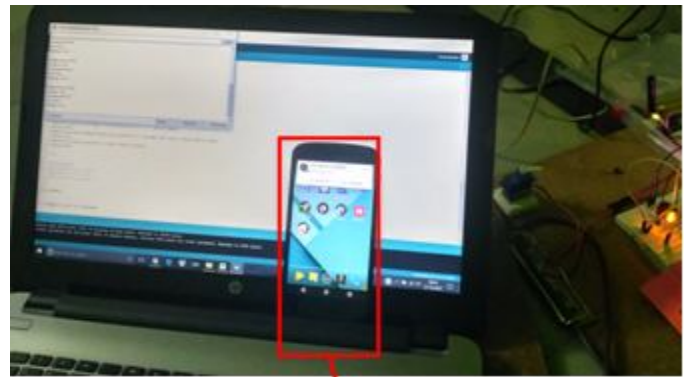


Fig.10 Incoming call to registered mobile from GSM

When temperature goes above set limit. Then call will go to registered number from GSM modem. Hence the problem can be solved by attending the problem personally. Otherwise Arduino will control the water pumping by means of servo motor. The temperature value is sent to cloud service hence it can be monitored from anywhere in the world.

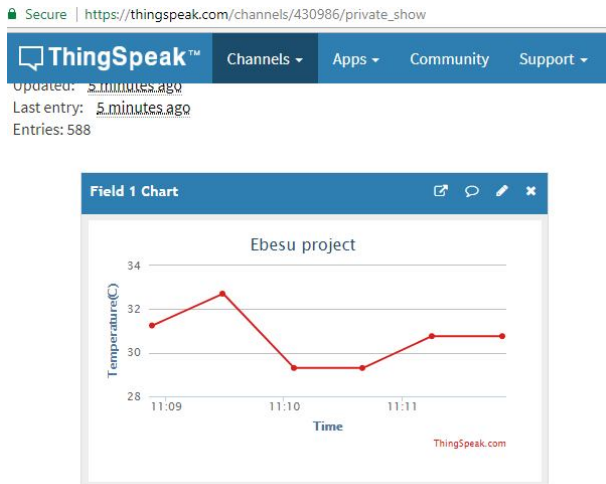


Fig.11 Temperature reading from Arduino through GSM

VI. CONCLUSIONS

Thus, the vermicompost (vermicast) atmosphere is maintained in required conditions with optimum energy usage by this project. The chance of dying of earth worms due to higher temperature is eliminated. It is the cost-effective production with the higher throughput. Temperature parameter is monitored using the GSM module. The parameters can be monitored from anywhere in the world with internet access. The rich-nutrient organic fertilizers are produced with the maintenance of proper temperature. This vermicast has not only gives the essential nutrients but also acts as buffer for the soil. This vermicast improves the quality and quantity of nutrient resulting in quick absorption of nutrients and this will increase the growth of the plant. Vermicast useful as healthier organic fertilizers than farmyard manure and inorganic fertilizer.

REFERENCES

- [1] *International Journal of Innovative and Emerging Research in Engineering, Volume 3, Special Issue 1, ICSTSD 2016 Organic Kitchen Waste Vermicompost Bin for Smarter City Waste Management.* Rupali M. Pund, Assistant Professor, Department of Civil Engineering, P.R.M.I.T&R, Badnera, Amravati, India
- [2] A Survey on Internet of Things: Security and Privacy Issues *International Journal of Computer Applications (0975 – 8887) Volume 90 – No 11, March 2014*
- [3] Internet of Things (IoT) -Description of Technology, Business Ecosystem, Issues and Challenges. Dr. B. Sundar, IFS, Director, Electronic delivery of services, Government of Andhra Pradesh
- [4] *International Journal of Advanced Research in Engineering and Technology (IJARET)*, Effect of vermicompost on nutrient uptake and their influence on biochemical parameters of selected vegetable plants. M. Lakshmi Prabha1, M. Shanmuga priya 2* 1 Department of Biotechnology, Karunya University, Karunya Nagar, Coimbatore-641114, Tamilnadu, India. 2Department of Biotechnology, MVJ College of Engineering, Near ITPB, Channasandra, Bangalore - 560067, Karnataka
- [5] “Automated vermicompost plant”, project reference no.: 37S1004, Abhijith G R, Adarsh B, Anium S R, Pruthvi raju H R
- [6] www.arduino.cc
- [7] www.futurelec.com
- [8] www.electronicsforu.com