

DESIGN AND FABRICATION OF SMART AGRICULTURE SPRAYER

K.VENKATESH¹, B.GANESH², G.KUSHAL³, M.DINESH⁴, J.SURESH KUMAR⁵.

^{1,2,3,4}Student of Mechanical Engineering Department, Nadimpalli Satyanarayana Raju Institute of Engineering and Technology (Autonomous), Visakhapatnam – 531173.

⁵Faculty of Mechanical Engineering Department, Nadimpalli Satyanarayana Raju Institute of Engineering and Technology (Autonomous), Visakhapatnam – 531173.

Abstract:

The aim of this project is to create an intelligent spraying robot that will decrease pesticide use and human health damage, allowing farmers to be protected and labour intensity can be reduced. More than 60 percent of the population in India do agriculture as the primary sector occupation. At present, due to increase in shortage of labour, interest has raised for the development of the autonomous vehicles like robots in the agriculture field. A system called “Design and Fabrication of Smart Agricultural Sprayer” has been designed to minimize the labour cost of farmers in addition to increasing the speed and accuracy of the work. The Proposed system is designed with the multipurpose autonomous agricultural Smart vehicle which can be controlled through ESP module, for spraying pesticide on the plants but not in free space, The project was tested on the field, The robot is successfully able to move in all the direction. Pesticide spraying unit is capable of spraying pesticide only on the plant not in the free space.

Introduction:

Agriculture is the primary source of revenue for India's population, which accounts for nearly 60% of the country's total. Farmers work in their fields to cultivate various crops based on the environment and resources available. Farmers must use large quantities of pesticides to increase food production in order to meet such high food demand for such a large population. Traditional manual pesticide spraying operations is full of direct exposure to the pesticide liquid work environment, great harm to human body and when this pesticide may come into contact with the farmer during spraying, which may trigger skin cancer and asthma illnesses. Increased pesticide spraying can impact consumer health as it enters the food chain. We have therefore created an automated robotic system that can spray pesticides in restricted quantities only if pests are discovered to solve the above-mentioned problems.

Descriptions:

Agriculture plays an essential position in the Indian financial system. For the rural population, agriculture is a vocation for their livelihood. All farmers use pesticides, including organic farmers. Whether from artificial or natural sources, insecticides are utilized by all farmers. The difference is organic farmers can best use insecticides from natural resources. But both synthetic and herbal insecticides have various stages of toxicity. Today solutions hugely rely upon heavy chemicals. A pesticide is a substance utilized for controlling, obviating, and ravaging pests. But when farmers spray the pest, it's far a very harmful procedure for them, they want to be very cautious like sporting proper clothes, gloves, masks, etc.

Literature Review:

"Fabrication of Automatic Pesticides Spraying Machine" This paper suggests machines which will save time and operational cost. Also saves human from affecting adversely. According to idea in our project we are making a small 4-wheel kart or vehicle which is electronically operated by a wireless remote which runs on power source as a DC battery. One vertical arm is attached at center of vehicle and one horizontal arm at top of the vertical arm. Nozzle is fitted to these arms so that it can spray pesticides both the sides. As more no of nozzle are there hence spraying is done rapidly and time and money is saved.

Components used:

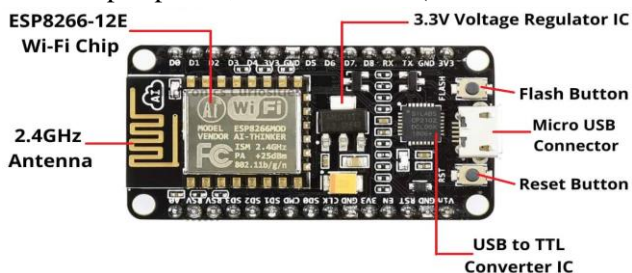
1. Node MCU ESP 8266
2. Temperature and Humidity sensor Module
3. Soil Moisture Sensor Module
4. Motors
5. Pump
6. Relay
7. Motor Driver Module
8. Nozzle
9. Battery
10. Wheels
11. Pesticide Tank
12. DC adapter for Arduino power source
13. Bracket
14. On-off Switch
15. Jumper Wires

Node MCU ESP 8266::

The ESP8266 module enables micro controllers to connect to 2.4 GHz Wi-Fi, using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a self-sufficient MCU by running an RTOS-based SDK. The module has a full TCP/IP stack and provides the ability for data processing, reads and controls of GPIOs.

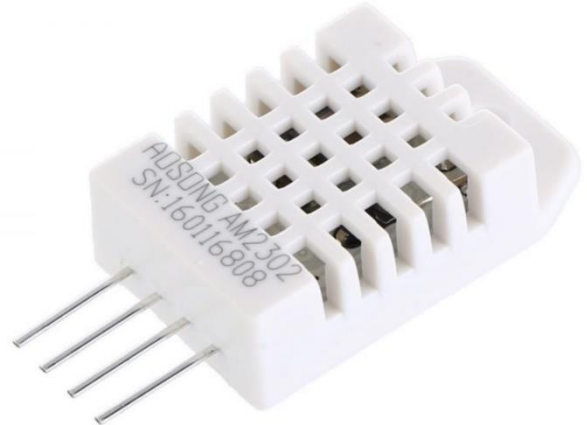
Based on the ESP8266 Wi-Fi transceiver module and the CH340 USB converter chip, this compact (Open Source) development and prototyping board is ideal for IOT applications.

The Wi-Fi module is compatible with the 802.11 b/g/n standard at 2.4 GHz, has an integrated TCP/IP stack, 19.5 dBm output power, data interface (UART / HSPI / I2C / I2S / Ir Remote Control GPIO/ PWM) and PCB antenna.



DHT22 Temperature and Humidity sensor

DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor with a calibrated digital signal output. It uses exclusive digital-signal-acquisition technique and temperature & humidity sensing technology; it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.



Pump:

A pump is a mechanical device that is used to move fluids, such as liquids or gases, from one place to another by mechanical or electrical means. Pumps work by using energy to create a pressure difference between the input and output sides of the device, allowing the fluid to flow through the pump and out the other side. There are many different types of pumps, including centrifugal pumps, positive displacement pumps, and vacuum pumps, each with its own unique characteristics and applications. Pumps are widely used in a variety of industries, including agriculture, construction, and manufacturing, as well as in residential and commercial settings, such as water supply systems and heating and cooling systems. They play a crucial role in many industrial and everyday processes, and their versatility and reliability make them an essential tool in many different fields.



Motor:

A 12-volt DC motor is specifically designed to operate at a voltage of 12 volts DC. DC Motor is a rotary motor that can convert direct current into mechanical energy or convert mechanical energy into DC power. It means that the 12-volt DC Motor can inter convert electric energy and mechanical energy. 12-volt DC Motors are known for their efficiency and ability to provide consistent and reliable rotational motion at the specified voltage. When it is operated as a DC Motor, electric energy is converted into mechanical energy. Overall, 12-volt DC motors are versatile and widely used in a multitude of applications where a reliable and controllable source of rotational motion is needed, especially when powered by a 12-volt DC power source.



Motor Drive L293D:

This L298N motor driver module is a high-power motor driver module for driving dc and stepper motors. this module consists of an L298N motor driver ic and a 78m05 5V regulator. L298N module can control up to 4 DC motors, or 2 DC motors with directional and speed control.



12V Lithium Battery

The 12V lithium battery stands as a pinnacle of portable power technology, offering a compact and efficient energy storage solution for a wide range of applications. Leveraging the high energy density and lightweight characteristics of lithium-ion chemistry, these batteries have become indispensable in powering various devices, from electronics and automotive systems to renewable energy installations and portable appliances.



Conclusion:

We will make design & and development, safety, performance & and sustainability, this innovative technology not only enhances the efficiency of pesticide and nutrient application but also minimizes environmental impacts by reducing the overuse of chemicals. These systems contribute to the preservation of ecosystems and the reduction of chemical runoff into water bodies. Smart agricultural spraying systems have the potential to revolutionize the way that crops are protected from pests, diseases, and weeds.



References:

<https://www.researchgate.net/publication/330728179> *A Review On Pesticides Sprayer Technology Approach In Ergonomics Economics And Ecologic In Agriculture Field*

<https://www.researchgate.net/publication/352295785> *Advancements of Spraying Technology in Agriculture*

<https://www.sciencedirect.com/science/article/pii/S0021863485900800>

<https://www.researchgate.net/publication/328530276> *Soil temperature Sensors in Agriculture and the role of Nanomaterials in Temperature Sensors Preparation*



[*Chapter Sensors in Agriculture*](https://www.researchgate.net/publication/375519915)

[*special issues/agriculture*](https://www.mdpi.com/journal/sensors/special_issues/agriculture)