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Autonomous Robot Spray

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ABSTRACT: The use of pesticides and herbicides is a common practice in floriculture, agriculture and horticulture to control pests and weeds and to improve crop yield and quality. However, traditional methods of spraying can be labour-intensive, time-consuming, and may lead to the wastage of chemicals. The development of an automatic spraying robot for floriculture and agriculture provides a solution that can reduce labour and farmers efforts and chemical costs. The objective of this project is to design and develop an automatic spraying robot for floriculture and agriculture that can optimize the use of pesticides and herbicides and improve crop and its quality. The proposed system consists of a mobile robot equipped with a spraying mechanism, sensors, and a control system. The spraying mechanism is designed to deliver the right amount of pesticide or herbicide to the crop, based on the crop type, growth stage. The sensors detect the crop, and adjust the spraying parameters accordingly. The control system is responsible for the overall operation of the robot, including navigation, obstacle avoidance, and communication.

Keywords: Robot spray, Espressif Systems, automation, mobile operated.

I. INTRODUCTION

With flourishing technology that is introduced in this 21st century, there is numerous types of robots been used in agricultural and floriculture activity starting from the cultivation process to the production process. The autonomous robot had been introduced in various application such is in underwater, rescue, line following robot used on metal detection. In agriculture field, the usage of robotics in agriculture operation able to help to increase the production process and improve efficiency. One of the types of the robot used in agriculture is for the purpose of pesticide spraying with the ability to navigate in the farm, recognize the target and regulate the spraying mechanism. The use of autonomous robot pesticide sprayer as the substitution of the worker who used conventional pesticide sprayer can be applicable. Besides, the demand for the agriculture robot also stimulates the consciousness of how important its role in the current and future generations

II. PREVIOUS WORK

[1] Yash Dnyaneshwar Jiwtode [July 2022]: Smart Pesticide Spraying Robot. Autonomous Pesticide Spraying Robot is the engineering solution by spraying the high toxic chemicals for the defected plants at exact location of the plant by taking all the health hazards and saves the farmer from the prevention of harm chemicals with in a confined space.

[2]. Neema Amish Ukani [July 2022]: Pesticide Simulation System. Application of intelligent control in spraying pesticide simulation system it is designed and the main theme of this project is to spray the pesticides to the crops. A electric spraying rod is created that performs operation of sprinkling the pesticides, as it is in snake like structure it will easily undergo to entire farm.

[3] Sandeep Sonaskar, Saurabh S. Chakole [July 2022]: Software and Hardware for Intelligent Sprayer. The main goal of this study was to design and develop software and hardware for an intelligent sprayer that can control variable-rate spray outputs through the nozzles based on availability of a target in sight and density level of the canopy sprayed. This has been accomplished to a large degree.

III. PROPOSED METHOD

A. Components Used:-

ESP32: The main component of our proposedmodel is ESP32 cam microcontroller. The ESP32 has an inbuilt facility of Wi-Fi and Bluetooth connectivity that allows us to easily control the model from a distance. ESP32 CAM is a 16-pin IC that has SoC features.

CAMERA: The ESP32 has an inbuilt camera application with developed DIP applications. The camera module will enable us to use Image

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Processing to atomise the spraying mechanism. The data / pictures collected with the camera module would be a database to predict annual yield and also enable the farmer to have close surveillance over the farm.

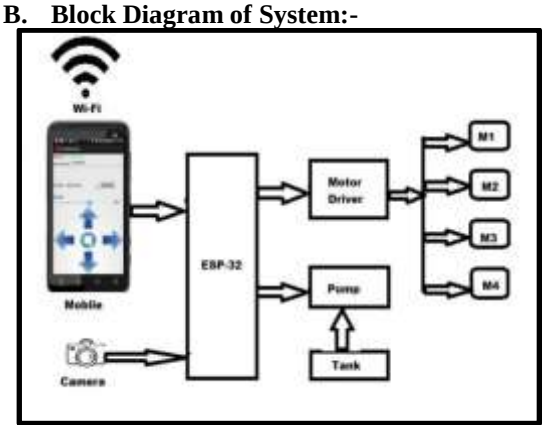
DRIVER MODULE: We use motor drivers to give high power to the motor by using a small voltage signal from a microcontroller or a control system. If the microprocessor transmits a HIGH input to the motor driver. The driver will rotate the motor in one direction keeping the one pin as HIGH and one pin as LOW. We are using L298N driver module.

WIFI: Wi-Fi is used for establishing connection between ESP-32 and the user via the mobile phone.

PUMP: The pump connects the supply tank to the sprinkler. We are using Plastic Earth 4002 model of agricultural use pump for the spraying operation.

MOTORS (M1, M2, M3, M4): The vehicle needs to perform turning movement along with to and Fro motion. We are using 4 motors for the 4 wheels of the vehicle

B. Block Diagram of System:-



STEP 1: START

In this step power supply will be switched on. All the access of power supply will be given to the user over an mobile application. Once the user clicks on the ON button the system will be started i.e. ESP32 will start the application. Pump and driver module will be ready to use.

STEP 2: ESTABLISHING CONNECTION

In this step the user's mobile phone establishes WIFI connection with the ESP 32. A webpage with all the required commands appears on the user's screen

STEP 3: SENDING COMMANDS

As the user clicks the buttons on the web page commands are given and processed by the ESP32 thus, they are further given to the pump and driver module for running of the vehicle.

STEP 4: VEHICLE MOVEMENT

As per the commands given by the user the vehicle is moved in the required direction.

STEP 5: SPRAYING THE PESTICIDES

When the user clicks "PUMP ON" button given on the interface the spraying starts and is continued until the user clicks the button "PUMP OFF".

Explanation: The software initially checks the connection established between the user's mobile phone and ESP32, simultaneously it verifies the Wi-Fi connection established.When the connection is successfully established, the camera setup is started. Once the camera setup is completed the live footage is being displayed on the user's mobile phone.When the user clicks any button on the webpage it is read by the software as a JavaScript event.Here we classify the events into two types:-

1. Pump ON/OFF
2. Vehicle movement

The program uses the SWITCH CASE algorithm in order to check the occurrence of an event.

If the user clicks Pump ON / OFF button, the corresponding function to switch on and off the pump is executed.

If the user clicks vehicle motion buttons i.e. UP / DOWN, LEFT/RIGHT the program executes according to following case structure:-

CASE 1: executed when the user clicks UP
CASE 2: executed when the user clicks DOWN
CASE 3: executed when the user clicks LEFT
CASE 4: executed when the user clicks RIGHT
CASE 5: executed when the user clicks STOP
CASE DEFAULT: It is executed when the user does not click any button.

The above algorithm runs in an infinite loop until the operation is stopped manually by the user.

IV. RESULTS

A. ESP32 And mobile phone connection:-

Once the power supply is switched "ON", the ESP32 starts hotspot connection with the user's mobile via, Wi-Fi the user can now view the home page of the website.

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Website

B. Controller and Motor connection:-

For testing the motor and controller connection the user clicks on the forward, backward, left, and right buttons and checks the corresponding movement of the vehicle. Also, the user can view the live footage through the camera on the website.

Wire Connection

C. Range Testing:-

The table below shows the range of ESP32 tested under 2 conditions:

1. Without Obstacles: These results were tested on an open field to determine range in line of sight model.
2. With obstacles: These results were observed in a two-storey house with doors and walls.

DISTANCE	RESULTS (WITHOUT OBSTACLES)	RESULTS (WITH OBSTACLES)	COMMENTS
10m	Excellent	Excellent	All controls run smoothly.
15m	Excellent	Very Good	All controls run smoothly.
20m	Excellent	Good	The camera was lagging a little bit.
25m	Good	Poor	The camera was lagging a little bit.
30m	Poor	Poor	The camera showed distorted images

Internal Circuit

Result

V. CONCLUSION

The model created can be used for sustainable agricultural and floriculture activities and can prevent hazardous health effect on farmers. It helps to locate the device with the web cam and the four motor drives provide proper balance to the vehicle. It is easy to operate on mobile phones and has high range testing's. The system provides efficient and effective solution to the farmer's needs.

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