Project Report

on

PESTICIDE SPRAYING ROBOT

Submitted to

Shri Ramdeobaba College of Engineering & Management, Nagpur

(An Autonomous Institute Affiliated to Rashtrasant Tukdoji Maharaj Nagpur University)

for partial fulfillment of the degree in

Bachelor of Engineering

(Information Technology)

Sixth Semester

by

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Under the Guidance of

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2021-22

CERTIFICATE

This is to certify that the Project Report on

"PESTICIDE SPRAYING ROBOT"

is a bonafide work and it is submitted to

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For partial fulfillment of the degree in

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during the academic year 2020-21

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ABSTRACT

Despite the emphasis on industrialization, agriculture remains the most important sector of the Indian economy, both in terms of GDP contribution and as a source of employment for millions of people across the country. Agriculture is extremely important to the Indian economy. More than 70% of rural households rely on agriculture as their primary source of income. However, pest infestations in crops are one of the key issues limiting agricultural production growth. The diagnosis of crop disease is critical in dealing with this type of problem. So, we'd like to present an engineering solution to address this challenge, in which an automatic pesticide sprayer is used to apply the pesticide to a specific area. This technique is based on a pesticide-filled sprayer. Sprayer movement is controlled by a low-speed DC motor that moves up and down according to plant height. The design includes two processing modules as well as automatic pesticide spraying. The proposed system can be controlled remotely using any electronic device, such as a mobile phone or a wireless solution. Farmers will be able to solve their human resource difficulties with this clever approach.

LIST OF FIGURES

CHAPTER 1
INTRODUCTION

INTRODUCTION

Farming is done in India utilizing modern ways. It is even more irregular because most of our farmers lack proper comprehension. The forecasts are based on a significant portion of farming and agricultural operations, which occasionally fail. Farmers are often the victims of tremendous losses and the source of suicide. Given the benefits of optimum soil moisture and consistency, air quality, and irrigation in crop growth, these parameters cannot be overlooked. As a result, we developed a novel approach for crop monitoring and intelligent farming. We believe our concept will be a landmark in the agriculture because of its dependability and remote monitoring. Our idea is to digitalize agriculture and farming operations so that farmers can watch crop requirements and accurately forecast their development. Surely, this idea will help their company reach new heights and become more profitable. Our approach relies heavily on farmer awareness, which we believe will be easily developed due to its numerous benefits.

1.1 Introduction

Agriculture is the primary source of revenue for India's population, which accounts for almost 60% of the country's total. Farmers work in their fields, cultivating various crops based on the environment and available resources. Farmers must use significant quantities of pesticides to increase food production in order to meet such high food demand for such a vast population. Other significant biological parameters such as pests and diseases affect crop yield, and these parameters can be controlled by humans to improve crop production. Farmers, on the other hand, must take numerous precautions when spraying pesticides, including wearing appropriate clothing, gloves, and masks. In such instances, the deployment of robots is a highly imminent technological solution that increases production and efficiency. Controlling pest infestation production is really important. Pest infestation is causing serious problems for farmers. Pests are unwanted insects or diseases that disrupt human activity by biting, destroying food plants, or making farming more difficult. Early detection and avoidance of pests is critical in crop management. Understanding pests and their habitats is necessary for effective pest control. Pesticides are currently being sprayed throughout farmers' fields. The main drawbacks of this practise are that the pesticide may come into contact with the farmer during spraying, potentially causing skin cancer and asthma. As pesticides penetrate the food chain, they may have an impact on consumer health. Pesticides are sometimes sprayed on crops that are not impacted, resulting in the same waste. To address the aforementioned issues, we developed an automated robotic system that can spray pesticides in limited quantities only when pests are detected. This not only protects the farmer from life-threatening illnesses and physical problems, but it also saves him money due to chemical restrictions. As a result, it aids the economic development of farmers and, by extension, the nation. Using this type of robot, the time spent spraying pesticide liquid is reduced, and it will also assist farmers in reducing their workload in any season or condition.

1.2 Objective

The primary goals of this project are to design a mechanism for spraying and managing parameters such as spraying pace control, tank status monitoring, and to deliver a pesticide/fertilizer spraying tank on it that can travel across any type of terrain, change the height of spraying using liner traversing mechanisms, which will allow the advanced system to spray at various heights for various plants, and to sprinkle pesticides aerially. By upgrading the spraying procedure, this system will save farmers time and money while also lowering labor costs.

1.3 Study of Problem Statement

The World Health Organization estimates that 3 million people are poisoned by pesticides each year, resulting in up to 220,000 fatalities, mostly in developing nations. Others may irritate the skin or eyes, while carbonates impair the nerve system. Some pesticides may cause cancer, while others may alter the body's hormone or endocrine system. Children, like other young and developing organisms, are particularly exposed to pesticides' negative effects. Even relatively low amounts of exposure during childhood can have negative health consequences. Memory loss, loss of coordination, reduced speed of response to stimuli, impaired visual capacity, altered or unpredictable mood and general behavior, and reduced motor abilities are all possible side effects of pesticide exposure.

This research aims to reduce the harmful effects of pesticides on humans (as compared to manual pesticide sprayers) and to cover bigger areas of land while spraying pesticides in a shorter amount of time. The workforce in a backpack sprayer must carry the entire weight of the pesticide-filled tank, which produces weariness and hence limits human capability. The engine-driven spraying equipment requires gasoline to run and function properly, which increases its operating costs and causes back pain due to vibration. The fertilizer is squandered in the aerial spraying approach, and it is not ideal for small farms. When fuel-powered cars are used, the exhaust fumes released by the Silencer or muffler cause a detrimental effect on crops, reducing crop productivity and endangering people.

CHAPTER 2
LITERATURE SURVEY

LITERATURE SURVEY

This chapter reviews recent research and developments in the subject of agricultural automation as described in the literature by various authors. The following is a brief summary of the study:

2.1 PAPER 1: Philip J. Sammons, Furukawa Tomonari, and Bulgin Andrew:

An engineering solution for spraying potentially harmful chemicals in the restricted area of a hot and steamy glasshouse to the current human health concerns is an autonomous pesticide spraying robot for use in a greenhouse. This is accomplished by inventing and building a self-contained mobile robot that may be used to control insects and prevent illness in commercial greenhouses. The capacity of the platforms to man oeuvre themselves efficiently through the rows of a greenhouse demonstrates the success of this technology, while the pesticide spraying system effectively covers the plants with spray uniformly in the appropriate dosages. The results demonstrated that the robot met the National Greenhouse Horticulture Centre's physical specifications, allowing it to work in their greenhouses. The robot also worked within the confines of time and money. The robot could drive up and down the greenhouse's rails. The rails are successfully sensed and operated by the Induction Proximity Sensors. When travelling along the tracks, another thesis student's spraying system was able to selectively spray selected plant groups in the greenhouse. The spray protection ensured that the crops received an adequate and uniform dose.

2.2 PAPER 2: Application of Intelligent Control in Spraying Pesticide Simulation System:

According to their article, a Smart control simulation model for pesticide spraying is proposed based on configuration embedded software investigations. The wireless information collecting network is built by a variety of terminals that connect to the upper device via a dedicated NC network in the system design. In the terminal design for data collecting, we make extensive use of modular system design methodologies. Intelligent control systems with various functions can be easily obtained by integrating the top computer with various software modules. The creation of an intelligent pesticide spraying simulation allows for the development of a number of new techniques and crafts. Modular structure design approaches for measurement and control system creation improve design performance, integrity, and system maintenance ease, as well as the method of measuring-universality. control's The proposed system can simulate all types of situations under natural conditions, according to experimental data. It also improved the test's efficiency and research comfort. The proposed system provides excellent measurement accuracy and is easy to use. All of these can establish the groundwork for future research into pesticide precision spraying technology.

2.3 PAPER 3: Philips J Sammons et al.:

Presents a solution to the current health concerns caused by toxic chemical spraying in a warm, vaporous glasshouse enclosed setting. This can be accomplished by developing an autonomous robot capable of spraying pesticides in limited spaces while avoiding human health risks. The efficient ability of the robot to traverse the line, while the spraying of pesticides covers the plants with its efficient dose spray, demonstrates the system's performance. This study is limited to the development of greenhouse robots that spray insecticides. The optimization of carbon dioxide, fertilizer feed, pest and fungus within the greenhouse helps the plant to thrive in the atmosphere. Carbon dioxide levels in the green house are five times those in the natural environment. The greenhouse's optimal temperature and humidity are consistently high throughout the day. When the temperature rises over 38 degrees Celsius, the air becomes extremely hot for those wearing masks. This can result in heat strokes, dehydration, and, in certain cases, hazardous disease in the long run.

CHAPTER 3
PROPOSED WORK

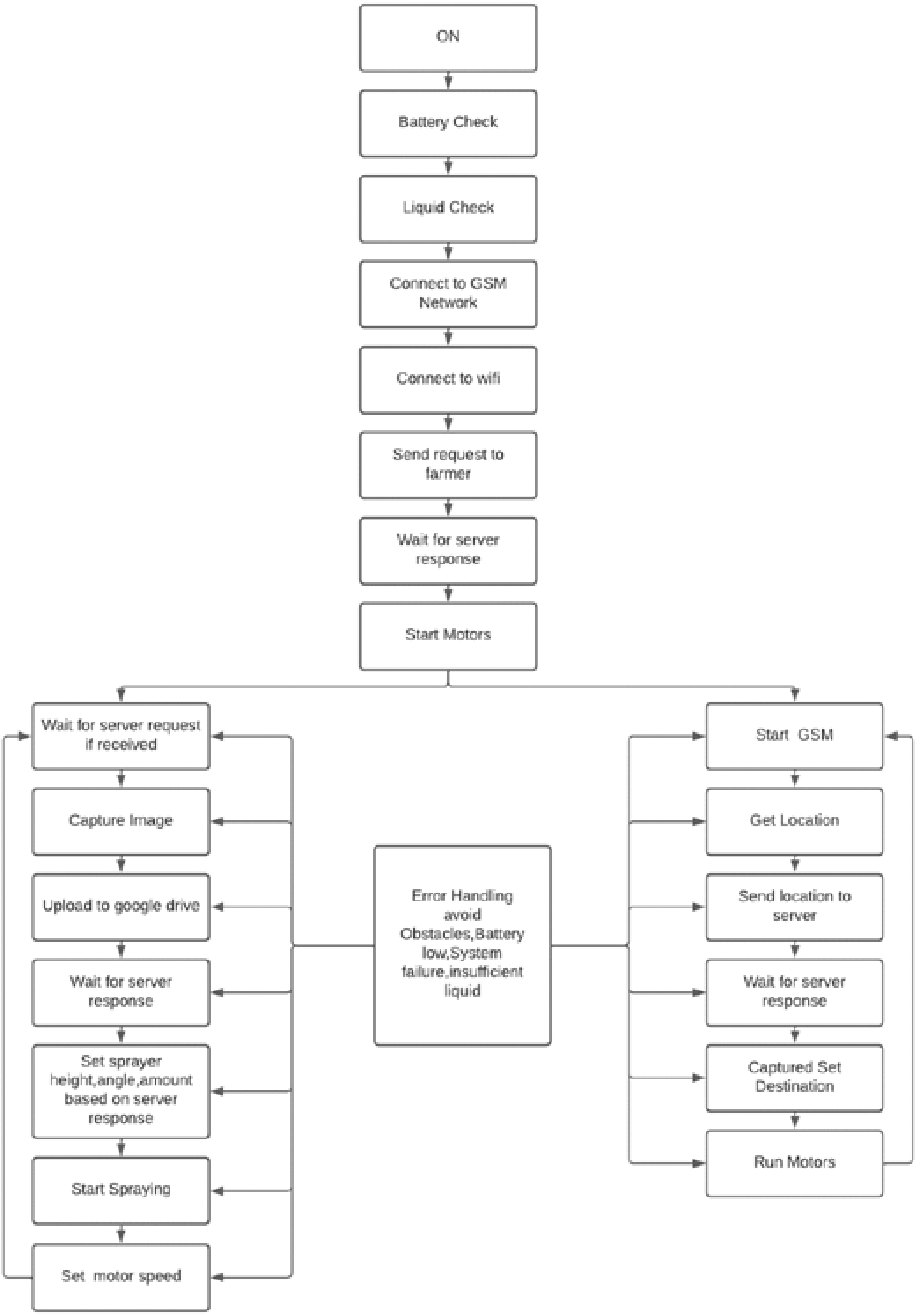
PROPOSED WORK

Agricultural automation with robots is an attempt to lessen the strain of managing a farm on a small and big scale by automating typical tasks such as pesticide spraying. A robot with four stepper motors is part of the system. Stepper motor drivers, Arduino UNO, and spraying tool. The broad concept that will be used to address the issue of automated pesticide spraying.

This agricultural robot decreases farmer’s general attempts and also improves the work's pace and precision. This robot has been created to improve application precision and yield. This project is basically divided into two components

1. Robot Movement
2. Pesticide Spraying Mechanism

Working Flow:



A. Robot Movement:

DC motors are used for the robot's motion that is governed electronically by ESP 32. Bluetooth module receives signals from the input and sends them to the controller, which in turn spins the engine. By obtaining the signal, DC motors are switched ON and OFF by allowing ESP32 to have a specific pin. An adequate velocity is provided by DC motors.

B. Image Processing

Firstly it will camera will capture the image and upload it on google drive. Then the image will be processed and detect the disease if it contains disease then it will send response to the server . After receiving response it will set the sprayer according to the height, angle and amount of pesticide to be sprinkled. Then it will start spraying the pesticide.

C. Pesticide Spraying Mechanism:

Bluetooth module connects to the digital key of ESP32, which receives the signal installed on the operator's Smartphone from the Android app. Sprayer spray the pesticide only when the leaves has disease. According to leaf requirement that particular amount of pesticide will be sprinkle.

CHAPTER 4
COMPONENT SPECIFICATION

COMPONENT SPECIFICATION

1.**Motor**

Figure 4.1 Motor

- Geared motor is a simple DC motor with gear box attached to the shaft of the motor which is mechanically commutated electric motor powered from direct current
- 60 RPM 12v DC geared motors for robotics applications
- It gives a massive torque of 7kgcm.
- Power Source is DC

2. **Motor Shaft**

When considering the best device for the device and its shaft, you should consider primarily the cost.
The material used for a typical car shaft is a soft metal, but when high strength is required, alloys such as chromium-vanadium, nickel, and nickel-chromium are used.

3. **Bearings and mount**

Figure 4.2 Bearing

Simple machine design
Installed solutions include rolling bearings, housing, signs, and other elements, and can be attached to any surrounding machine structure. You can design a machine structure with strips and frames, welded, stitched or stitched together without the need for high precision. Your surrounding building does not need to be a casing, which provides precision machined seats.
Easy installation
Mounted bear solutions are easy to install. Houses are attached to their support area. The connection to the shaft can be made with fixed screws lock collar , SKF ConCentra lock technology (fig. 3), or with an adapter or retractable sleeve . Apart from the adapter and retractable sleeves, the other three locking methods do not require the knowledge and tools you normally need to mount a bearing.
Reliable carrying function
SKF information on ring bearings, housing design, sealing, and lubrication in the case of mounted units, has been compiled to provide the products that deliver the desired performance.

Another factor that supports reliable operation is the ability of bear bearings to compensate for the inconvenience. When using mounted bearings solutions, you can usually not align the two shaft bases around the shaft accurately. Many of the solutions included compensate for errors by adjusting the bearings on the housing or by using the bearing bearings.

4. Motor Driver

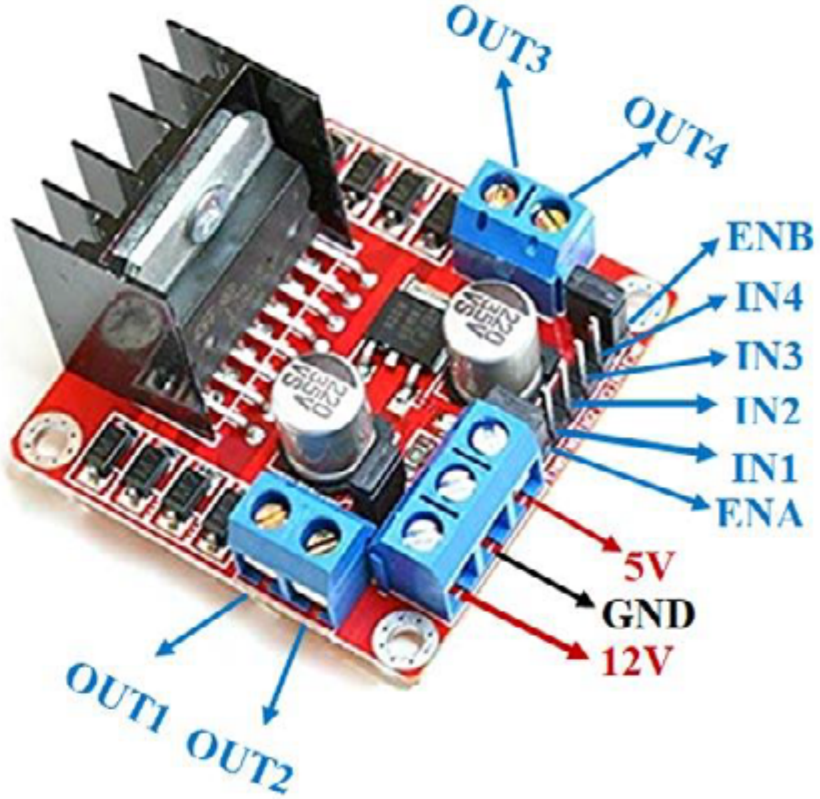


Figure 4.3 Motor Driver

- Driver Model: L298N 2A
- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Logic Voltage: 5V
- Driver Voltage: 5-35V
- Driver Current:2A
- Logical Current:0-36mA
- Maximum Power (W): 25W
- Current Sense for each motor
- Heatsink for better performance
- Power-On LED indicator

L298N Module Pinout Configuration

Pin Name	Description
IN1 & IN2	Motor A input pins. Used to control the spinning direction of Motor A
IN3 & IN4	Motor B input pins. Used to control the spinning direction of Motor B
ENA	Enables PWM signal for Motor A
ENB	Enables PWM signal for Motor B
OUT1 & OUT2	Output pins of Motor A
OUT3 & OUT4	Output pins of Motor B
12V	12V input from DC power Source
5V	Supplies power for the switching logic circuitry inside L298N IC
GND	Ground pin

5. **Servo Motor**

Figure 4.4 Servo Motor

Model	MG995
Weight(gm)	55
Operating Voltage (VDC)	4.8 ~ 7.2
Operating Speed @4.8V	0.20sec/60°
Operating Speed @6.6V	0.16sec/60°
Stall Torque @ 4.8V (Kg-Cm)	10
Stall Torque @6.6V (Kg-Cm)	12
Operating Temperature (°C)	-30 to 60
Dead Band Width (µs)	1
Gear Type	Semi-Metal
Rotational Degree	180º
Servo Plug	JR
Cable Length (cm)	30
Length (mm)	40.5
Width (mm)	20
Height (mm)	44
Shipment Weight	0.059 kg
Shipment Dimensions	9 × 8 × 6 cm

6. ESP 32 Cam

Figure 4.5 ESP32 CAM

Input Voltage (Volt)	5
Operating Temperature (°C)	-20 ~ 85
SPI Flash	Default 32Mbit
RAM	520KB SRAM + 4MB PSRAM
Bluetooth	Bluetooth 4.2 BR/EDR and BLE standards
Wi-Fi	802.11 b/g/n/
UART Baudrate	115200 bps
Image Output Format	JPEG(OV2640 support only), BMP, GRAYSCALE
Spectrum Range	2412 ~2484 MHz
Shipment Weight	0.082 kg
Shipment Dimensions	8 × 6 × 2 cm

7. GSM Module

Figure 4.6 GSM Module

Chipset	ESPRESSIF-ESP32 240MHz Xtensa® single-/ dual-core 32-bit LX6 microprocessor
FLASH	QSPI flash 4MB / PSRAM 8MB
SRAM	520 kB
USB to TTL	CP2104
On-board clock	40MHz crystal oscillator
Working voltage	2.7V-3.6V
Working current	70mA
SIM card	Only supports Nano SIM card
Power Supply	USB 5V/1A
USB	Type-C
Working Temperature Range (°C)	-40 to 85
Length (mm)	77
Width (mm)	29
Height (mm)	12
Weight (gm)	17
Shipment Weight	0.02 kg
Shipment Dimensions	9 × 5 × 1 cm

8. Logical Level Convertor

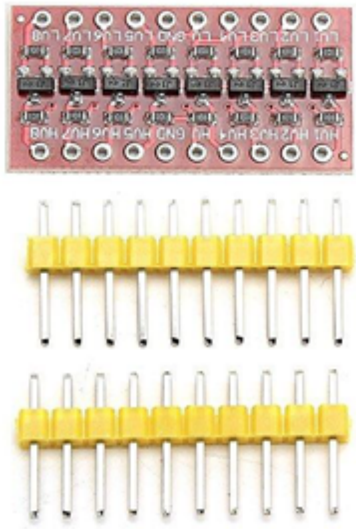


Figure 4.7 Logic Level Convertor

Material	Plastic + metal
No. of Channels	8
Input Voltage (V)	3.3 ~ 5
Length (mm)	28
Width (mm)	14
Height (mm)	3
Weight (gm)	2
Shipment Weight	0.005 kg
Shipment Dimensions	6 × 5 × 1 cm

9. **Buck Convertor**

Figure 4.8 Buck Convertor

Input Voltage	5-12V
Input Mode	Soldering
Output Voltage	3.3V
Maximum Output Current	3A
Maximum Conversion Efficiency	97.5%
Full load temperature	30 Â°C
Switching Frequency	500KHz
Voltage Regulation	Â±0.5%
Dynamic Response Speed	5% 200uS
Shipment Weight	0.014 kg
Shipment Dimensions	4 × 3 × 1 cm

10.Charger

Figure 4.9 Charger

11. Pesticide Sprayer(Dual Motor)

Figure 4.10 Pesticide Sprayer

Brand	Kristal
Material	PVC
Color	Orange
Capacity	16L
Discharge Pressure	0.2 - 0.45 Mpa
Maximum Discharge Flow	3 LPM
Work Efficiency	90 %

12.Battery

We are using 12v 8Ah battery.

CHAPTER 5
SYSTEM DESIGN

SYSTEM DESIGN

A. Hardware

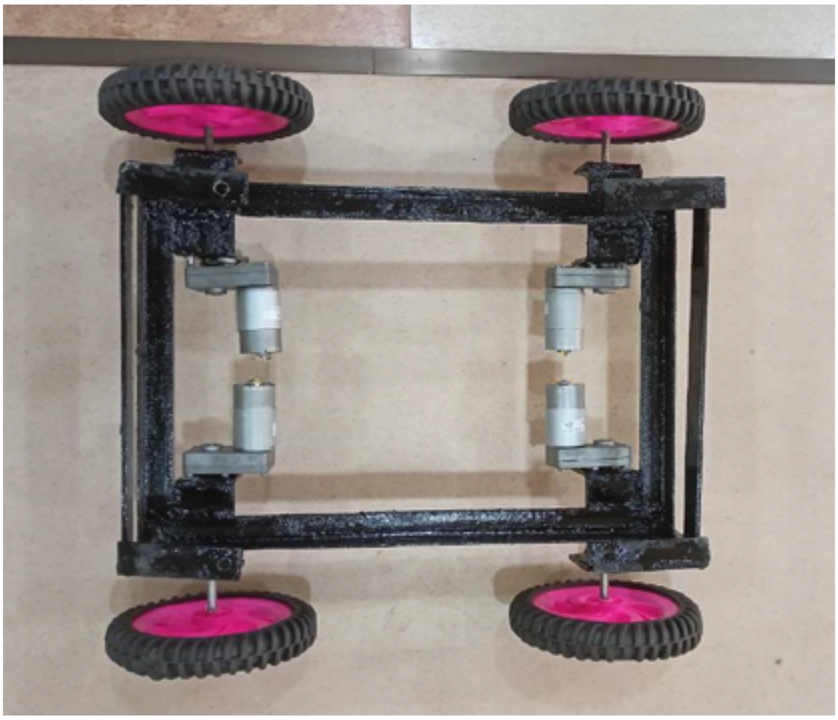


Figure 5.1 Top View of Bot

Figure 5.2 Side View of bot

Figure 5.3 Front View of the bot

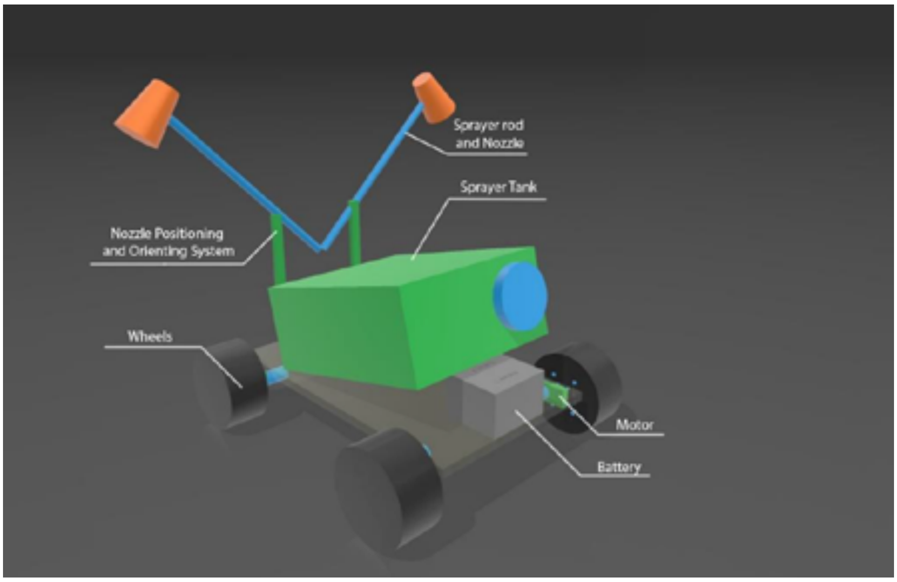


Figure 5.4 Basic Design of bot

B. Software

Client Side Code:

```
#include <WiFi.h>
#include <WiFiClientSecure.h>
#include "soc/soc.h"
#include "soc/rtc_cntl_reg.h"
#include "Base64.h"

#include "esp_camera.h"
const char* ssid     = "*******";
const char* password = "**********";

String script =
"**************************************************";
String lineNotifyToken = "token=**********";
String folderName = "&folderName=ESP32cam_images";
String fileName = "&fileName=ESP32-CAM.jpg";
String image = "&file=";


//CAMERA_MODEL_AI_THINKER
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27

#define Y9_GPIO_NUM       35
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22
```

```
void connectWiFi()
{
  WiFi.begin(ssid, password);
  //Serial.println("Connecting");
  long tim ;
  tim = millis();
  while (WiFi.status() != WL_CONNECTED)
  {
   //    delay(50);
   //    digitalWrite(12, HIGH);
   //    delay(50);
   //    digitalWrite(12, LOW);
   Serial.print(".");
   if (millis() - tim > 3000)
     ESP.restart();
  }

  Serial.println("");
  Serial.print("Connected to WiFi network in " + String(((millis() - tim) /
1000.0)) + " seconds with IP Address: ");
  Serial.println(WiFi.localIP());
}

void configCam()
{
  camera_config_t config;
  config.ledc_channel = LEDC_CHANNEL_0;
  config.ledc_timer = LEDC_TIMER_0;
  config.pin_d0 = Y2_GPIO_NUM;
  config.pin_d1 = Y3_GPIO_NUM;
  config.pin_d2 = Y4_GPIO_NUM;
  config.pin_d3 = Y5_GPIO_NUM;
  config.pin_d4 = Y6_GPIO_NUM;
  config.pin_d5 = Y7_GPIO_NUM;
  config.pin_d6 = Y8_GPIO_NUM;
  config.pin_d7 = Y9_GPIO_NUM;
  config.pin_xclk = XCLK_GPIO_NUM;
  config.pin_pclk = PCLK_GPIO_NUM;
  config.pin_vsync = VSYNC_GPIO_NUM;
  config.pin_href = HREF_GPIO_NUM;
  config.pin_sscb_sda = SIOD_GPIO_NUM;
  config.pin_sscb_scl = SIOC_GPIO_NUM;
```

```
  config.pin_pwdn = PWDN_GPIO_NUM;
  config.pin_reset = RESET_GPIO_NUM;
  config.xclk_freq_hz = 20000000;
  config.pixel_format = PIXFORMAT_JPEG;

  // init with high specs to pre-allocate larger buffers
  if (psramFound())
  {
    config.frame_size = FRAMESIZE_XGA;
    config.jpeg_quality = 10;
    config.fb_count = 2;
  }
  else
  {
    config.frame_size = FRAMESIZE_SVGA;
    config.jpeg_quality = 12;
    config.fb_count = 1;
  }

  esp_err_t err = esp_camera_init(&config);
  if (err != ESP_OK) {
    Serial.printf("Camera init failed with error 0x%x", err);
    delay(100);
    ESP.restart();
  }

}

void setup()
{

  pinMode(12, OUTPUT);
  //  digitalWrite(12, HIGH);
  //  delay(100);
  //  digitalWrite(12, LOW);

  pinMode(4, OUTPUT);

  WRITE_PERI_REG(RTC_CNTL_BROWN_OUT_REG, 0);

  Serial.begin(115200);
  //  delay(10);
```

```
  connectWiFi();
  configCam();
}

void loop()
{
  SendCapturedImage();
  delay(1000);
}

String SendCapturedImage() {
  const char* myDomain = "script.google.com";
  String getAll = "", getBody = "";

  camera_fb_t * fb = NULL;
  digitalWrite(4, HIGH);
  delay(10);
  sensor_t *s = esp_camera_sensor_get();
  s->set_brightness(s, 2);
  s->set_contrast(s, 0);
  fb = esp_camera_fb_get();
  delay(20);
  digitalWrite(4, LOW);
  if (!fb) {
    Serial.println("Camera capture failed");
    //delay(1000);
    ESP.restart();
    return "Camera capture failed";
  }

  Serial.println("Connect to " + String(myDomain));
  WiFiClientSecure client_tcp;
  client_tcp.setInsecure();   //run version 1.0.5 or above

  if (client_tcp.connect(myDomain, 443)) {
    Serial.println("Connection successful");

    char *input = (char *)fb->buf;
    char output[base64_enc_len(3)];
    String imageFile = "data:image/jpeg;base64,";
    for (int i = 0; i < fb->len; i++) {
```

```
    base64_encode(output, (input++), 3);
    if (i % 3 == 0) imageFile += urlencode(String(output));
  }
  String Data = lineNotifyToken + folderName + fileName + image;

  client_tcp.println("POST " + script + " HTTP/1.1");
  client_tcp.println("Host: " + String(myDomain));
  client_tcp.println("Content-Length: " + String(Data.length() +
imageFile.length()));
  client_tcp.println("Content-Type: application/x-www-form-urlencoded");
  client_tcp.println("Connection: keep-alive");
  client_tcp.println();

  client_tcp.print(Data);
  int Index;
  for (Index = 0; Index < imageFile.length(); Index = Index + 1000) {
    client_tcp.print(imageFile.substring(Index, Index + 1000));
  }
  esp_camera_fb_return(fb);

  int waitTime = 500;   // timeout 10 seconds
  long startTime = millis();
  boolean state = false;

  while ((startTime + waitTime) > millis())
  {
    Serial.print(".");
    delay(10);
    while (client_tcp.available())
    {
      char c = client_tcp.read();
      if (state == true) getBody += String(c);
      if (c == '\n')
      {
        if (getAll.length() == 0) state = true;
        getAll = "";
      }
      else if (c != '\r')
        getAll += String(c);
      startTime = millis();
    }
    if (getBody.length() > 0) break;
```

```
    }
    client_tcp.stop();
    Serial.println(getBody);
  }
  else {
    getBody = "Connected to " + String(myDomain) + " failed.";
    Serial.println("Connected to " + String(myDomain) + " failed.");
  }

  return getBody;
}


String urlencode(String str)
{
  String encodedString = "";
  char c;
  char code0;
  char code1;
  char code2;
  for (int i = 0; i < str.length(); i++) {
    c = str.charAt(i);
    if (c == ' ') {
      encodedString += '+';
    } else if (isalnum(c)) {
      encodedString += c;
    } else {
      code1 = (c & 0xf) + '0';
      if ((c & 0xf) > 9) {
        code1 = (c & 0xf) - 10 + 'A';
      }
      c = (c >> 4) & 0xf;
      code0 = c + '0';
      if (c > 9) {
        code0 = c - 10 + 'A';
      }
      code2 = '\0';
      encodedString += '%';
      encodedString += code0;
      encodedString += code1;
      //encodedString+=code2;
    }
```

```
    yield();
  }
  return encodedString;
}
```

Server Side Code:

```
function doPost(e) {
  var folderName = e.parameter.folderName;
  var file = e.parameter.file;
  var fileName = e.parameter.fileName;
  //var fileName = Utilities.formatDate(new Date(), "GMT",
"yyyyMMddHHmmss")+"-"+e.parameter.fileName;
  var token = e.parameter.token;
  var contentType = file.substring(file.indexOf(":")+1, file.indexOf(";"));
  var data = file.substring(file.indexOf(",")+1);
  data = Utilities.base64Decode(data);
  var blob = Utilities.newBlob(data, contentType, fileName);

  // Save a captured image to Google Drive.
  var folder, folders = DriveApp.getFoldersByName(folderName);
  if (folders.hasNext()) {
    folder = folders.next();
  } else {
    folder = DriveApp.createFolder(folderName);
  }
  var file = folder.createFile(blob);
  file.setDescription("Uploaded by " + fileName);

  var imageID =
file.getUrl().substring(file.getUrl().indexOf("/d/")+3,file.getUrl().indexOf("
view")-1);
  var imageUrl = "https://drive.google.com/uc?authuser=0&id="+imageID;

  // Send a link message to Line Notify.
  var res = "Line Notify: ";
  try {
    var url = 'https://notify-api.line.me/api/notify';
    var response = UrlFetchApp.fetch(url, {
      'headers': {
```

```
        'Authorization': 'Bearer ' + token,
      },
      'method': 'post',
      'payload': {
        'message': imageUrl
      }
    });
    res += response.getContentText();
  } catch(error) {
    res += error;
  }

  return
ContentService.createTextOutput(folderName+"/"+fileName+"\n"+imageUr
l+"\n"+res);
}
```

CHAPTER 6
COMPARISON AND RESULT

Comparison:

Hardware:

Motor:

New upgraded motor has rated torque of 37kg which is much greater than the motors used in previous version i.e., 7 kg. This upgrade makes sure that the bot will run seamlessly on rough surfaces.

Microcontroller:

Now used ESP32 based microcontroller comes with inbuilt Bluetooth and Wi-Fi support performs better in connectivity as compared to its competitor Arduino Uno. Also when interfaced with GSM module, gives robot an opportunity to contact with user any time in case of system failure and similar problems wirelessly. This helps to keep track on bot’s conditions easier.

Integrated GPS and Compass:

This version of bot is integrated with Compass and GPS module, so that the bot can keep track on its real time positioning. Previous version had to operate manually, but this version knowing its position can operate automatically.

Increased diameter of wheels:

Increased diameter of wheels provides smother and better transportation of bot in uneven and muddy terrain.

Use of Image Processing:

Using image processing the bot itself can identify the disease on plant, and amount of infection. This data can be used to calculate amount of pesticide to be sprayed and how much time it should be sprayed in a day/week.

Also, image can be used to determine the height of plant, using which the orientation of sprayer nozzle can be set.

Improved Battery:

New battery used in the system has specification of 12v 8Ah x 2 i.e., 12v, 16Ah, which should give more run time as compared to previous battery pack used which was 6v, 350mAh.

Software:

CNN Used:

Mainly to process and analyze digital images, with some success cases involving processing voice and natural language.

Advantage-

With little dependence on pre-processing, this algorithm requires less human effort. It is actually a self-learner, which makes the pre-processing phase, easier. For example, given many pictures of cats and dogs, it can learn the key features for each class by itself.

CNN has features parameter sharing and dimensionality reduction. Because of parameter sharing in CNN, the number of parameters is reduced thus the computations also decreased.

CNN over ANN:

Since digital images are a bunch of pixels with high values, makes sense use CNN to analyze them. CNN decrease their values, which is better for training phase with less computational power and less information loss.

CNN over MLP:

Both MLP and CNN can be used for Image classification however MLP takes vector as input and CNN takes tensor as input so CNN can understand spatial relation(relation between nearby pixels of image) between pixels of images better thus for complicated images CNN will perform better than MLP.

CNN over SVM:

Clearly, the CNN outperformed the SVM classifier in terms of testing accuracy. In comparing the overall correctives of the CNN and SVM classifier, CNN was determined to have a static-significant advantage over SVM when the pixel-based reflectance samples used, without the segmentation size.

CNN over KNN:

KNN and CNN perform competitively with their respective algorithm on the dataset, while CNN produces high accuracy than KNN and hence chosen as a better approach.

Result:

As the above comparisons showed CNN is better. That's the reason we choose CNN over other.

Future work:

- Using GPS to automate movement of bot.
- Using Image Processing to get disease on plant, hence to find amount of pesticide to be sprayed.
- Assembly of Bot.

CHAPTER 7
CONCLUSION

CONCLUSION

The potential for robot-enhanced productivity in agriculture is enormous, and robots are increasingly appearing on farms in various forms and in increasing numbers. The other issues with autonomous farm equipment can most likely be solved with technology. Although this technology may be in our future, there are compelling reasons to believe that it will not simply replace human drivers with computers. It may necessitate a reassessment of crop production methods. A swarm of little machines can produce crops more efficiently and cheaply than a few large machines. One advantage of the smaller machines is that they may be more acceptable to non-farmers. Because agricultural tasks are dangerous, demand intelligence, and need quick, but extremely repetitive decisions, robots can effectively replace human operators. Robots can help us live better lives, but they also have drawbacks. In our country, all agricultural machines are operated manually because using a petrol engine or tractor is expensive, and farmers cannot work for long periods of time manually, which is harmful to their health. To solve this problem, we need a system that is both efficient and user-friendly, as well as environmentally friendly because it does not produce pollution.

In comparison to the other types of solutions offered, the remotely operated pest sprayer is more superior. Furthermore, the various materials chosen for the complete mechanism will be readily available at a low cost. The farmer's major concern was carrying the entire load of bugs on his shoulder, and pesticides are toxic to farmers, causing several health problems. This problem can be overcome by using this method. In addition, it requires far fewer resources to operate in real-world situations. Furthermore, the farmer (operator) does not need any specific skills or training to run it, and it uses less manpower than traditional spraying methods.