

Fabrication Of a Rover for Pest Control and Soil Monitoring Using Computer Vision

Submitted in fulfillment of the requirements for the award of Bachelor
of Engineering degree in Mechatronics

by

Kishaan B.S (39090018)

Nishanth kumar R (39090034)



**DEPARTMENT OF MECHATRONICS ENGINEERING
SCHOOL OF MECHANICAL ENGINEERING**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC | 12B Status by UGC | Approved by AICTE
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**

MAY - 2023

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DEPARTMENT OF MECHATRONICS

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **Kishaan B.S (39090018)**, **Nishanth kumar R(39090034)** who have done the project work entitled “**Fabrication of a Rover for Pest Control and Soil Monitoring Using Computer Vision**” under our supervision from June 2022 to May 2023.

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Submitted for Viva Voce examination held on _____ May 2023

Internal Examiner

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DECLARATION

We, **Kishaan B. S(39090018)** and **Nishanth kumar R (39090034)**, hereby declare that the Project Report entitled “**FABRICATION OF A ROVER FOR PEST CONTROL AND SOIL MONITORING USING COMPUTER VISION** ” done by us under the guidance of **Dr. M. Sangeetha, M.E., Ph.D.** is submitted in fulfilment of the requirements for the award of Bachelor of Engineering degree in Mechatronics.

1. B. S. Kishaan

2. R. Nishanth Kumar

DATE: ____ May 2023

PLACE: Chennai, Tamil Nadu

SIGNATURE OF THE CANDIDATE

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I wish to express my thanks to all Teaching and Non-teaching staff members of the Department of Mechatronics who were helpful in many ways for the completion of the project.

ABSTRACT

As automation increases in agriculture field, this project resulted in making a monitoring robot for agriculture field without human. The main purpose was to see how cultivation growth can be increased. By using sensors, today's technologies we can increase the growth and cultivation for better. This project designs a monitoring system to monitor the soil and insects using sensors and computer vision system. The use of Raspberry pi 3A as a micro controller-where electrical components could be programmed. its became the control of all subsystems.

Moisture sensor was used to detect the soil dryness and computer vision is used to detect the insects to spray fertiliser. By this when soil became dry sensor detect it and start spray water using motor pump and using computer vision, we detect the insects which attract to delta trap and spray fertilizer.

Due to the use of high fertilizer plant became poisoning by this project we can reduce the use of heavy fertilizer by detecting the insects. The system spray fertilizer if insect was detected by computer vision. And by detecting the soil we can spray the water at correct time to reduce the plant getting withered.

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CHAPTER 1

INTRODUCTION

1.1 PEST CONTROL

Pest control is a serious concern for modern farmers and gardeners since it can harm crops and result in financial losses. To solve this issue, researchers have created robotic devices that detect and exterminate pests using computer vision. These robots use cameras to identify pests and then move independently towards them to spray insecticides to eliminate them. They have ultrasonic, infrared, and other sensors to identify impediments and navigate their surroundings. The robots may be programmed to patrol enormous areas and can be used both inside and outside. They can also be used to monitor the area for pests, allowing farmers to take prompt action if a pest is detected.

This project develops a computer vision system and sensor-based monitoring system for insects and soil. The ability to programme electrical components with Raspberry Pi microcontroller. Each subsystem's system became the system in charge. A moisture sensor was utilised to monitor how dry the soil was before spraying fertilizer, and computer vision was used to identify insects. When the soil becomes dry, the sensor detects it and begins spraying water with a motor pump. Using computer vision, we detect the insects that attract to the delta trap and sprinkle fertiliser. By detecting insects, we may reduce the usage of heavy fertiliser, which has poisoned plants due to the use of high fertiliser. The device treats insects detected by computer vision with fertiliser. Additionally, we can spray the water at the appropriate time to prevent the plant from withering by detecting the soil.

1.2 TYPES OF PEST CONTROL

The principal insects that harm cereal crops include rice fly, lesser grain borer, Indian meal moth, stored product beetles, termites, and cutworm. The sweet corn fly, warehouse beetle and rice weevil are the most damaging to vegetable crops. Pest management strategies in agriculture are grouped into four categories based on pest size. These are the procedures:

- Methods for pest control
- Physical pest control methods
- Chemical Cultural methods for pest control
- Biological methods for pest control

1.2.1 Physical Method of Pest Control

Physical pest control is a natural and non-chemical method of pest management. This pest control technique entails detecting pests and employing various strategies to eliminate them from the farm. Physical pest management, which is typically used for macro pests such as rodents, uses traps, hunting, alarm systems, security personnel, and other combative measures. These techniques are both safe and efficient for the crop and its consumers. They are also less expensive and require less labour compared to other pest control methods. Many farmers in Africa and Asia still depend on physical pest management to manage their crops. Physical pest control techniques are classified into three categories. The first seeks to deter pests while causing minimal harm to plants or people. This includes patrolling and inspecting security at night, as well as erecting metal wires and traps, as well as hiding places for pests, in the hopes that they will opt to leave the farm.

1.2.2. Chemical Method of Pest Control

Physical pest control is a natural and non-chemical method of pest management. This pest control technique entails detecting pests and employing various strategies to eliminate them from the farm. Physical pest management, which is typically used for macro pests such as rodents, uses traps, hunting, alarm systems, security personnel, and other combative measures. These techniques are both safe and efficient for the crop and its consumers. They are also less expensive and require less labour compared to other pest control methods. Many farmers in Africa and Asia still depend on physical pest management to manage their crops. There are three types of physical pest control techniques. The first uses metal wires, traps, and hiding places to make the farm less appealing to pests. For the elimination of pests from agricultural land, highly poisonous and toxic compounds are typically mixed with water at prescribed rates before administration via spraying onto the foliage or leaves of plants over multiple days

prior to harvesting; this pest control technique is primarily geared towards the mitigation of micro pest infestations such as aphids, armyworms, thrips and other pests

Pesticides are applied to farms in three stages:

- Before planting,
- During crop growth, and
- After harvest.

This is due to the fact that pest populations expand significantly faster than plant populations after planting since any pests identified on the plant are passed along to the following generation because they are all clones. As a result, insect control prior to seeding should be significantly more effective. Many insects have already relocated to other farms after harvest, either to hibernate or reproduce, making management simple by measuring the quantity of larvae present. Insecticides, for example, can be sprayed on the surface of the leaves without hurting the crop that has developed from beneath.

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1.2.3. Cultural Methods of Pest Control

Cultural approaches entail using several methodologies to create an unfavourable environment for pests. This type of pest control has two main applications it seeks to keep pests in check so that crops are not destroyed by them, and it also aims to reduce or prevent infestation so that it does not return.

It is used to keep pests at bay so that crops are not harmed. This type of pest control has two main applications, it seeks to keep pests in check so that crops are not destroyed by them, and it also aims to reduce or prevent infestation so that

it does not return. Pest management strategies used in crops include a variety of methods aimed at creating an unfavourable environment for the pests. The goal is to keep pests in check so that the crop is not destroyed by them, and to limit or prevent infestation so that it does not return.

This is also one of the natural pest control approaches. Cultural pest management approaches employ a variety of tactics or techniques targeted at creating an unfavourable environment for pests. Land preparation is an excellent example of this strategy; other examples include weeding, seed treatment, and so on; this is one of the simplest methods of pest management in agriculture. It is inexpensive and presents no risk to the consumer's or the environment's health.

1.2.4. Biological Methods of Pest Control

The biodiversity-based pest management strategy includes biological pest control. It advocates the notion of integrated pest control, in which all possible methods are employed to minimise damage to plant output while raising the population of natural enemies in order to avoid the usage of pesticides.

This is the most technological pest management strategy in agriculture; it entails using the pest's natural adversary to prey on them, such as using chicken to suppress grasshopper and nematode populations. It is also a combination of many pest management approaches to obtain a pest-free farm. It is also known as integrated pest management. It is technical and demands knowledge.

Biological pest control is a type of pest control that depends on pest predators, diseases, and parasites to minimise pest populations. This strategy integrates a new pest control science known as agro-ecology, which takes into account the role of natural enemies in pest control as well as the density of natural populations.

In order to increase agricultural productivity, farmers must create effective insect control strategies. Pests are present throughout the cropping season. Although the pest cannot be completely eradicated from the farm, it can be kept or managed to do less economic damage.

1.3 COMPUTER VISION

Computer vision is a monitoring tool, and machine learning is used to automate the process for repeatability. Trends and advancements in the field of agricultural Internet of things (IOT), as well as their applications, are explored. This helps to preserve data and expertise about large fields. It employs a variety of components such as sensors, transducers, and actuators. Variables include light, humidity, temperature, and soil moisture. Using machine vision and machine learning, the user may control and monitor field conditions from anywhere.

1.4 WORKING OF IMAGE PROCESSING

The signals obtained from the sensor are turned into a coloured image on the screen during the pre-processing stage in order to visualise the temperature difference and identify the flaws. The image is turned into a binary file during the processing stage.

CHAPTER 2

LITERATURE SURVEY

2.1 SOLAR POWERED AUTOMATED MULTI-TASKING AGRICULTURE ROBOT

A solar-powered multitasking vehicle for agriculture has been created by Jerosheja B R et al [1] with the goal of reducing farmer labour while enhancing the efficiency and precision of farming chores. This vehicle is capable of carrying out a number of jobs, including planting seeds, harvesting crops, keeping an eye on things, spraying pesticides, irrigating the area, spotting insects, and putting out fires in the field. An IoT interface is used to monitor the entire system, and a specially developed app may be used to control and keep an eye on the actions of the vehicle. A Raspberry Pi computer that has a 1.2GHz 64 quad-core processor powers the car and serves as the system's brain, managing all of the actions the car takes. The vehicle's camera serves as the "eye" of the system, automatically scanning the field. The car is additionally fitted with a solar panel to produce clean energy, enhancing its efficiency and environmental friendliness. The working process and the many components that communicate with it are shown in Figure 2.1. The vehicle is made to update farming methods, and by utilising IoT in agricultural settings, it increases the benefits of farming operations.

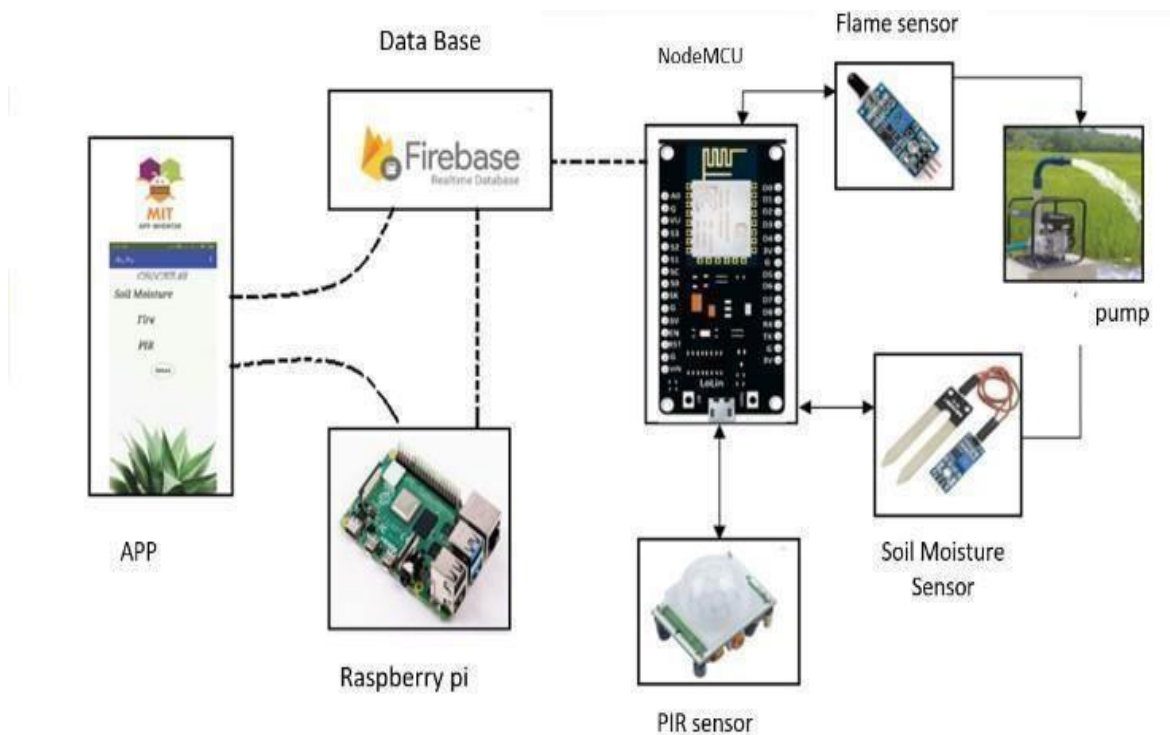


Fig:2.1 : Interfacing various components with IOT [1].

2.2 AGRICULTURAL ROBOT FOR MOISTURE DETECTION

An autonomous watering system that uses an Arduino microcontroller to measure the soil's moisture content and stop plants from wilting was created by Sharadha Parande et al. [2]. The system has a moisture sensor that measures the amount of moisture in the soil and an L203D module that turns on the water pump automatically. The software for the system was created using the Keil compiler, and it operates by monitoring the plant's moisture level and turning on the water pump via the L293D module when the soil moisture level falls below the plant's requirements. Figure 2.2's block diagram of the system demonstrates how different sensors and parts are integrated with the microprocessor and the motor. This autonomous plant watering system powered by Arduino is intended to help farmers save time and water.

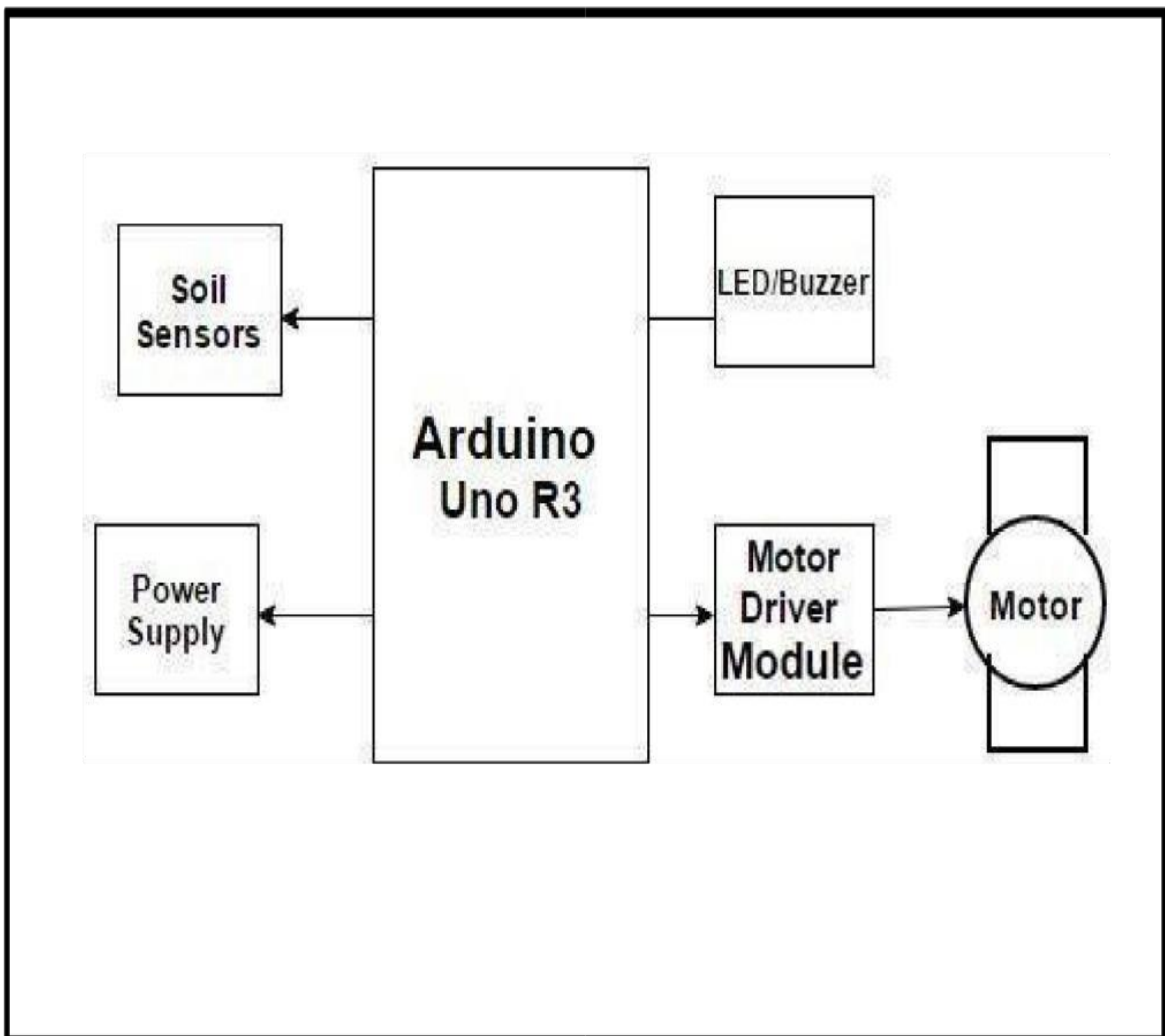


Fig:2.2 : Block diagram of motor driver module, sensors and microcontroller operations [2]

2.3 COMPUTER VISION TECHNOLOGY IN AGRICULTURAL AUTOMATION

An overview and analysis of computer vision's use to agriculture automation are given in this work. To detect, measure, and track objects for image processing, cameras and computers are employed rather than human eyes. This cutting-edge technology boosts efficiency and precision while reducing the need for manual labour. The six topics covered in the report Crop growth monitoring, disease prevention, autonomous harvesting, quality testing, automated management of modern farms, and monitoring field information with UAVs are all examples. The study looks at how computer vision is used in agriculture to manage modern farms automatically, identify and check agricultural products, harvest crops automatically, control diseases, pests, and weeds, and monitor farmland data with UAVs.

Nonetheless, there are several key challenges that computer vision technology must face in the field of agricultural automation, such as the need for strong performance in a variety of complex situations and the continual growth of application domains. Despite these challenges, the study provides in-depth assessments of computer vision in agriculture, demonstrating its benefits in terms of low cost, high efficiency, and high precision.

2.4 ROBOT FLEETS FOR ECOLOGICALLY FRIENDLY PEST CONTROL IN AGRICULTURE

In order to control weeds and pests in agriculture, Pablo Gonzalez-deSantos and colleagues have created, developed, tested, and evaluated a new generation of robotic and autonomous systems. They have used decision-making algorithms to effectively scan and target weed patches while using computer vision to identify them. Three agricultural tools have been created by the team: a patch sprayer that uses less herbicide, a canopy sprayer that uses less pesticide—roughly 50% less—and a mechanical/thermal instrument that eliminates 90% of weeds that are detected. Figure 2.3 illustrates how choices are made in response to data from sensors and other devices. This project highlights the application of automation and robotics in agriculture, resulting in the development of new automatic tools and robots for efficient weed management. The aerial robots are designed around a revolutionary hex-rotor drone with a two-camera perception system for remote

weed patch detection in crops planted in narrow rows, while the ground robots are developed around a commercial mobile platform outfitted with sensors.

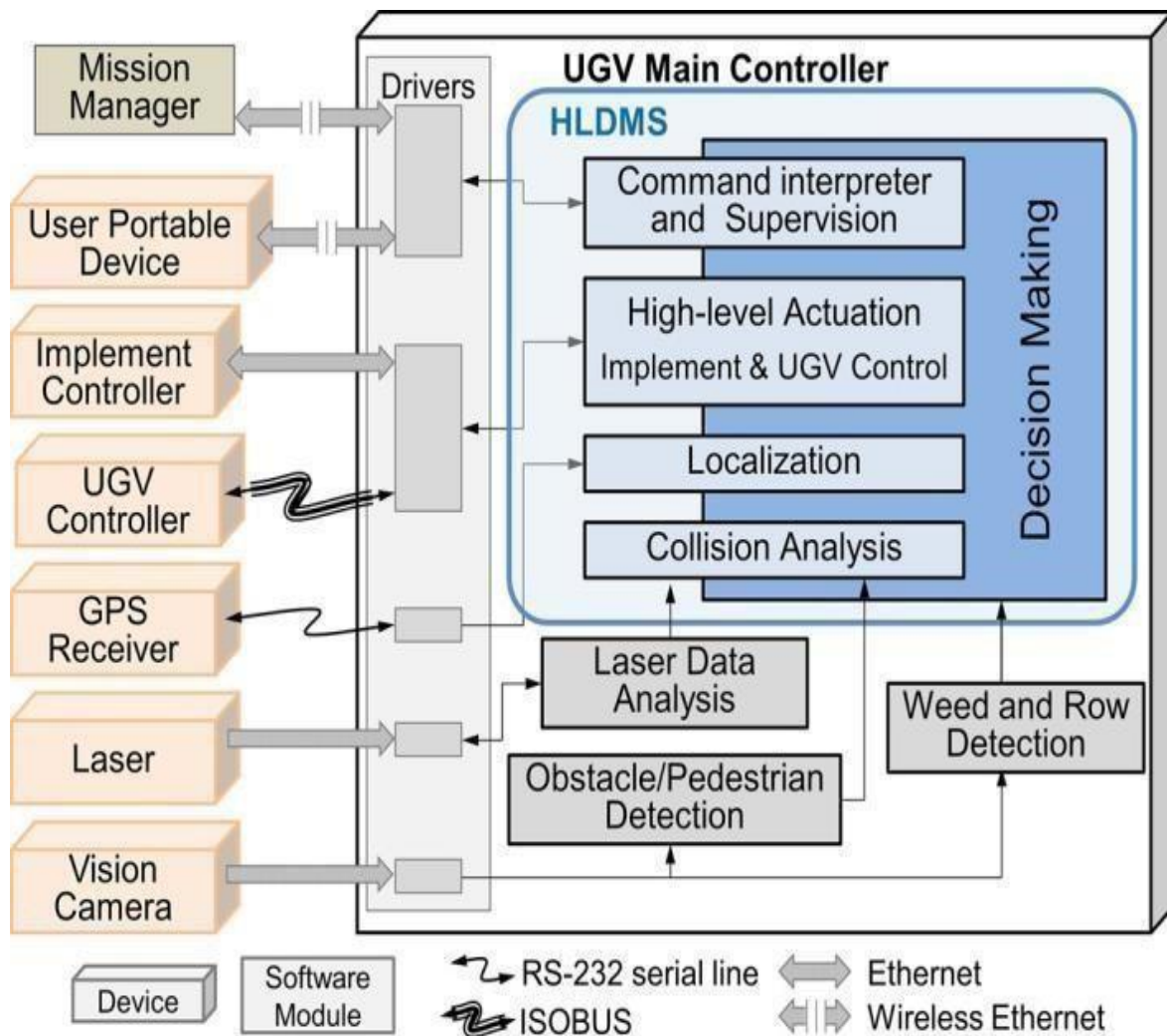


Fig:2.3 : Layout of the routines, functions and subsystems for decision making process [4].

2.5 SMART FARMING SYSTEM BASED ON INTELLIGENT INTERNET OF THINGS AND PREDICTIVE ANALYTICS

The goal of IoT adoption in agriculture and related industries is to fully automate conventional conservation farming practises. The system created by Ferehan et al collects data from remote sensors placed in the field using IoT devices, which is then sent to the Raspberry Pi CPU. This information can be utilised to make decisions, such as whether to water or fertilise crops or when to harvest them. The robot may be trained to carry out a variety of outdoor chores, including planting, watering, harvesting, and crop monitoring. Farmers may enhance their production

while cutting labour and costs by using IoT in agriculture. To help farmers manage their crops effectively, the technology can also deliver real-time data on weather patterns and soil conditions. In conclusion, Ferehan et al wireless .'s mobile robot is a promising example of an Internet of Things (IoT) application in agriculture that has the potential to transform the sector by giving farmers access to more accurate and effective farming techniques.

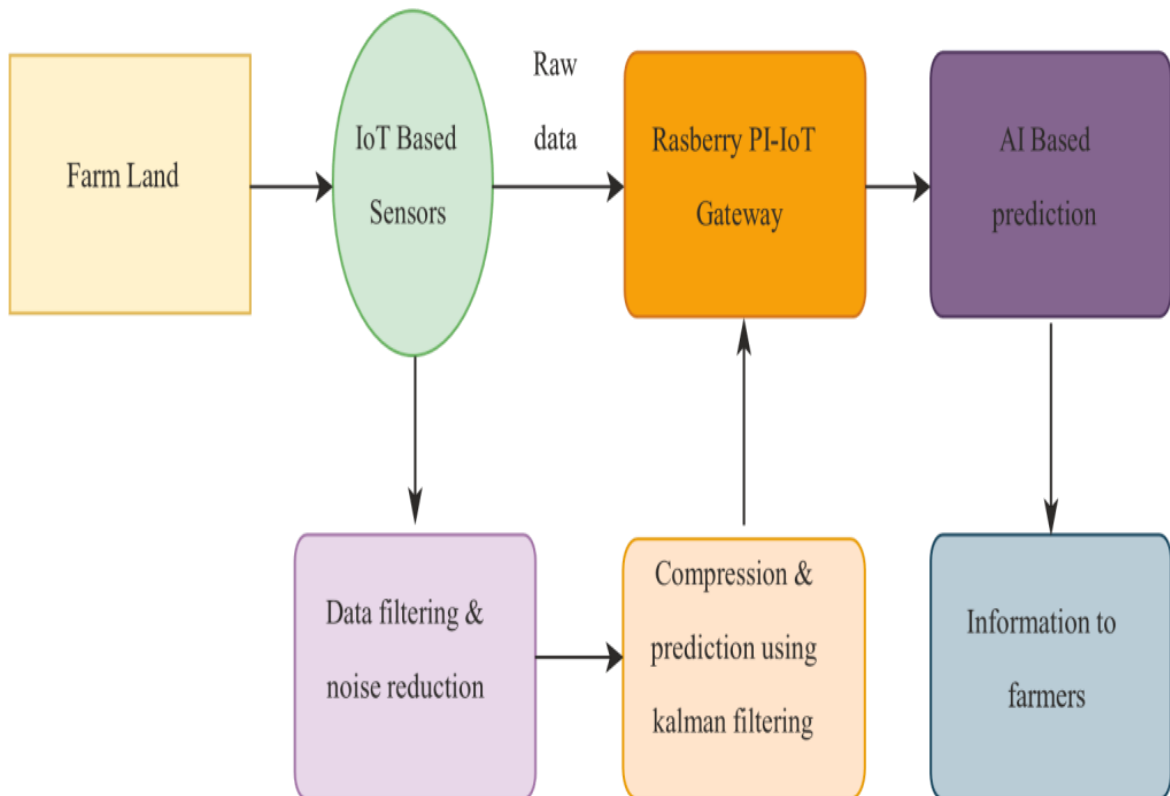


Fig:2.4 : IOT based system function [5]

2.6 DEVELOPMENT OF A SMART PESTICIDE SPRAYING ROBOT

PVR Chaitanya et al [6] focus on constructing a machine learning model that is employed in pest management by spraying pesticide over the sick plant in this paper. It evaluates images captured by the camera as part of the machine learning process. PVR Chaitanya et al [6] created a machine learning model for pest control that uses photos from a webcam to spray pesticides on diseased plants. The plant's visible elements, such as the stem and leaves, are examined for damage by the machine learning process. A Raspberry Pi3 microcontroller is

used to programme the robot's movements, and Python programming is used to carry out the programme, which instructs the robot to carry out particular tasks. The technology uses machine learning and image processing to identify pests early. Through the use of cameras and scanners, the infected plants are discovered, and the photos are then processed to find defects and categorise diseases. The hardware system, which consists of two pistons with pesticides and flow-controlling solenoid valves, is then used to spray pesticides. An algorithm is utilised to detect and spray pesticides, and a web camera is used to capture the live feed footage that is processed by a Raspberry Pi 3. The L293D motor control board, which powers the DC motors, receives the data from the processor and transmits it over Bluetooth to an Arduino Microcontroller, which controls the movement instructions.

The suggested system includes a number of operations, including the movement of robots, streaming video, and pesticide application. The system's software side also features a number of operations, such as feature extraction, disease categorization, image segmentation, image processing, and image pre-processing. Many illnesses are categorised according to a variety of characteristics, such as the pigmentation of the parts and harm to the plants. Fig. 2.5 illustrates how the robot and additional data inputs were integrated with the camera feed.

Raspbian OS, the operating system for the Raspberry Pi 3, VNC Viewer for controlling devices, and configuration to configure the device to conduct different actions on command from the user are among the software required. This cuttingedge technology can identify and categorise different plant diseases to increase agricultural yields while providing precise and constant pesticide flow.

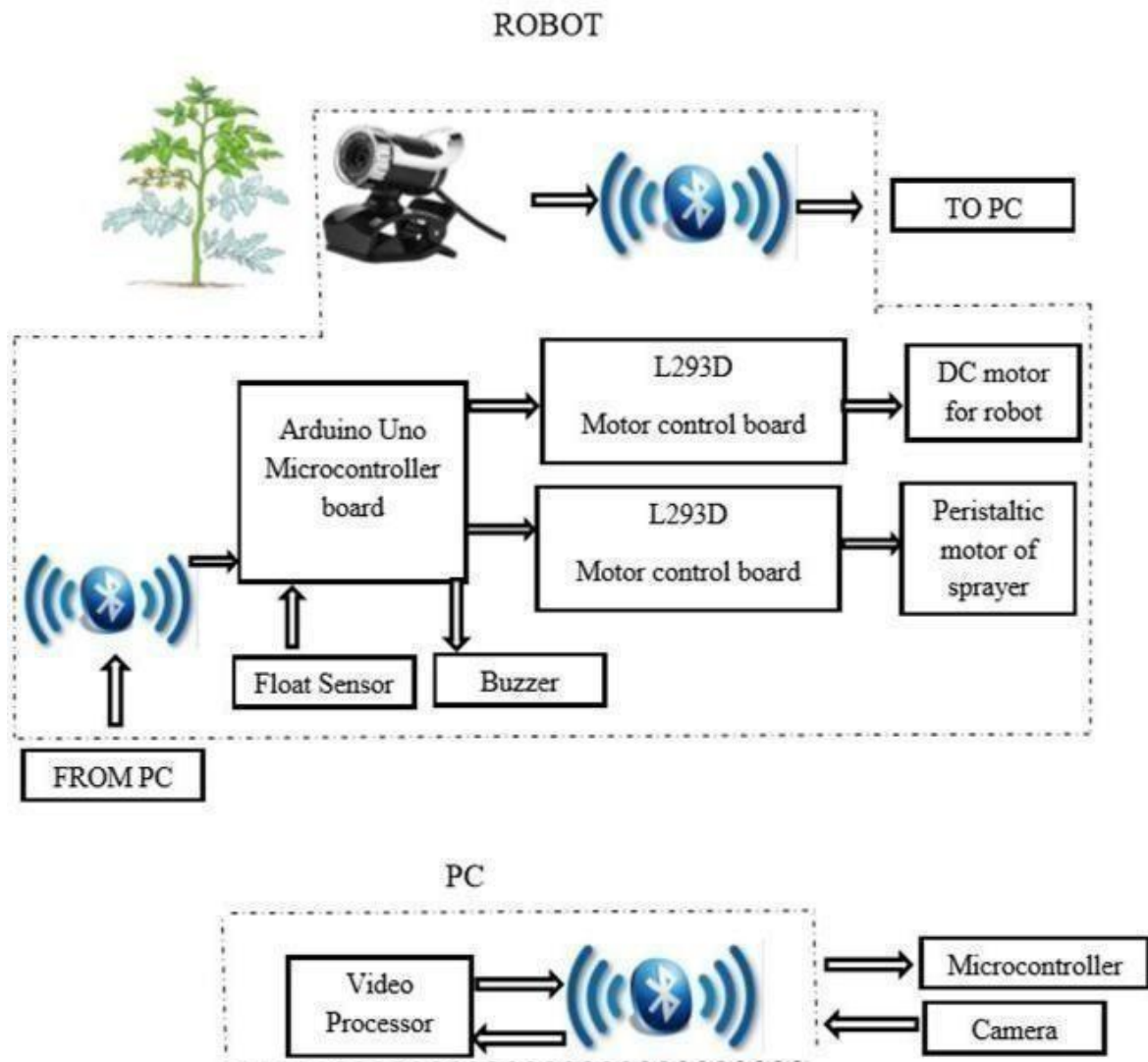


Fig:2.5 : Block diagram of Pesticide Spraying Robot [6].

2.7 MULTIPURPOSE AGRICULTURAL ROBOT

A study on the creation of a multipurpose solar-powered agricultural robot is presented by Gowtham Kumar S.N et al. in their publication [7]. The document gives a thorough explanation of how each robot component was made, along with information on its physical characteristics. The paper also analyses the system's production characteristics, including flaws and restrictions such as castability, weldability, surface characteristics, and shrinkage. The writers also analyse additional factors like the cost of production, the standard of the materials, their accessibility, the use of available space, the overall cost of operation, and the design.

The robot carries out a number of tasks, such as guiding, cultivating, spreading seeds, levelling, and spraying water. A pinion and rack system is used for steering, and a lead screw rod connected to a DC motor is used for cultivation, which turns the dirt and makes holes in which to plant seeds. A three-holed, sheet metal hopper box that is driven by a DC motor and operated by remote control is used by the robot to sow seeds. A sheet metal plate and sliding mechanism are used for levelling, and a DC motor and remote control provide the power. Last but not least, a water tank, a water pump, and a toggle switch are used to spray water. The design and operation of the various electronic and mechanical systems are shown in Figure 2.6 of the article.

- **Steering:**

The agricultural robot's steering system uses a pinion and rack system, where the pinion is coupled to a DC motor and the speed is controlled by relays. Remote controls are used to control the movement's direction.

- **Cultivating Operation:**

A DC motor rotates a lead screw rod that excavates the soil to a depth of 1.5 inches during the cultivating operation. A hole is made for planting seeds by moving the DC motor up and down.

- **Seed Sowing Operation:**

The seeds are kept in a hopper box made of sheet metal for the seed sowing operation. Three holes are drilled into the box, underneath of which is a wheel shaft. Remote control is used to operate a DC motor that is attached to the wheel shaft.

- **Levelling Operation:**

A sheet metal plate is made and used as a leveller to level the earth. To raise and lower the leveller, a sliding mechanism is used. A DC motor powers the leveller, which is also managed via a remote controller.

- **Water Spraying Operation:**

The water container on the robot is used to store water. A water pump is used to spray water, and it is attached to a pipe. Power for the pump is supplied using the toggle switch.

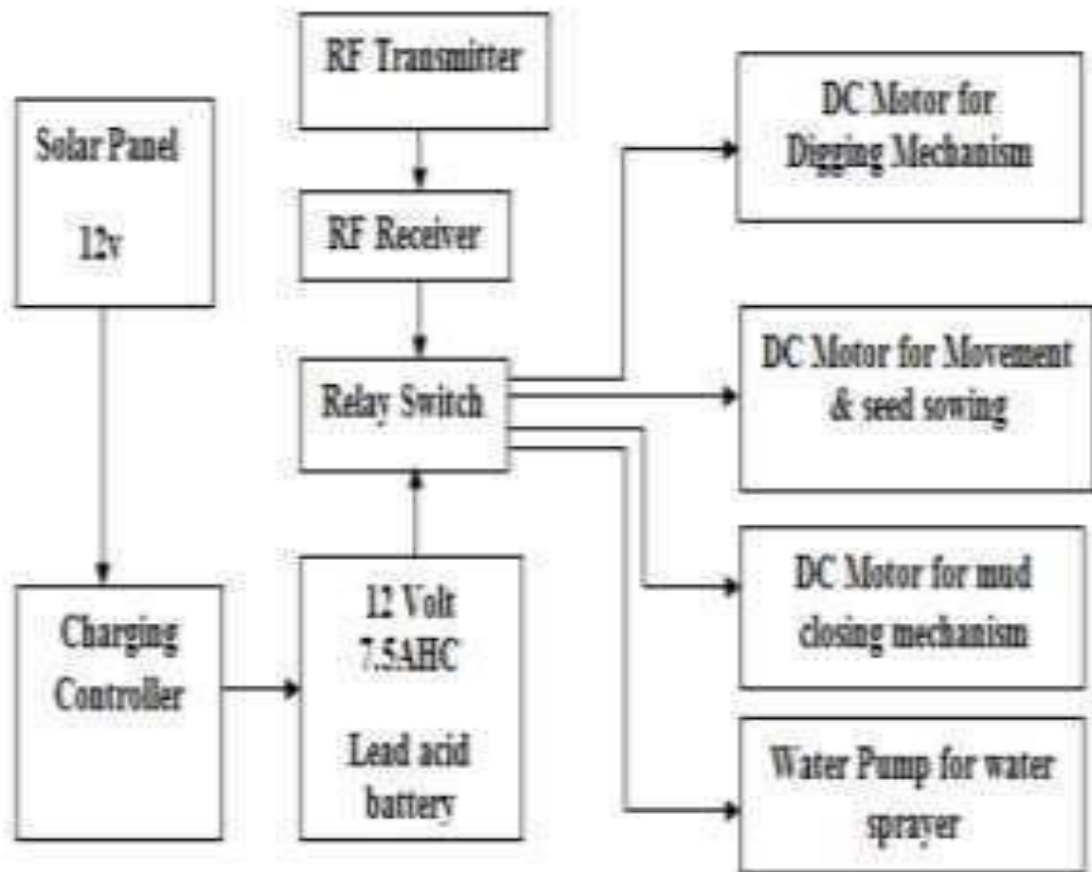


Fig:2.6 : Block diagram of Multipurpose Agricultural Robot [7].

2.8 AGRICULTURAL ROBOT FOR AUTOMATIC PLOUGHING AND SEEDING

The objective of Sneha Amrita et al [8] research is to create a flexible robot that can carry out a variety of activities automatically while also being able to be manually overridden for more specific duties that could be required during operations. The device also includes a humidity sensor, which detects the humidity levels in the immediate area and sends the results to the farmer through SMS. A plough, tiller, and wheel base are essential parts of the suggested system, which was built especially for precision farming techniques. Three cameras are also included for fruit harvesting and pesticide application. Four DC motors power the robot, and a DC robot linked to the plough aids in its movement. A servo motor controls the tiller's angular movement. An AVR microcontroller is utilised to interconnect the hardware and software components, as shown in Figure 2.7, which also shows the integration of the microprocessor with mechanical components. The microcontroller has separate programme and memory storage

and is an 8-bit RISC chip microcontroller. The robot uses an ultrasonic sensor to avoid obstacles, and Figure 2.8 shows how the CPU is integrated with other electrical components such as sensors and displays.

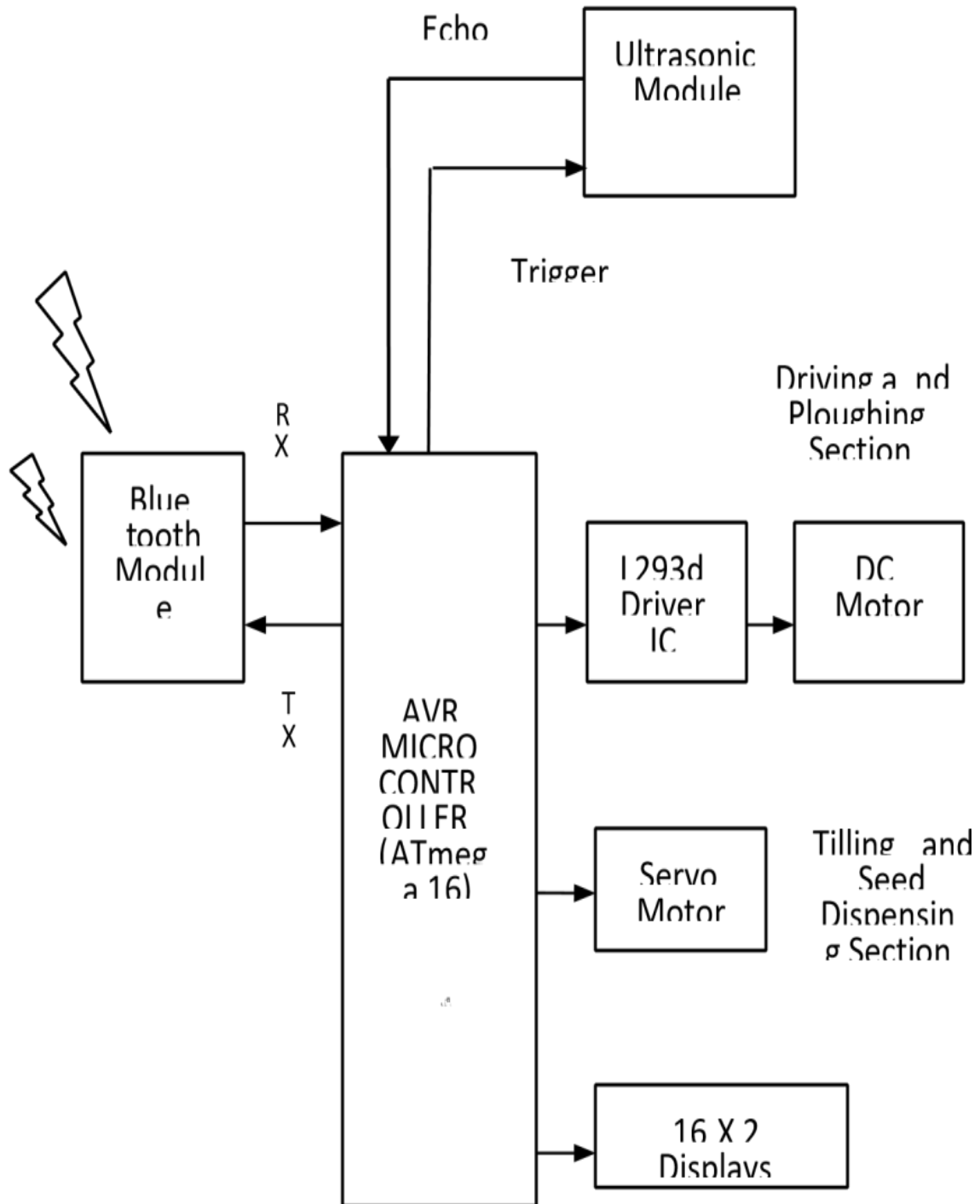


Fig:2.7 : Interfacing of mechanical components [8].

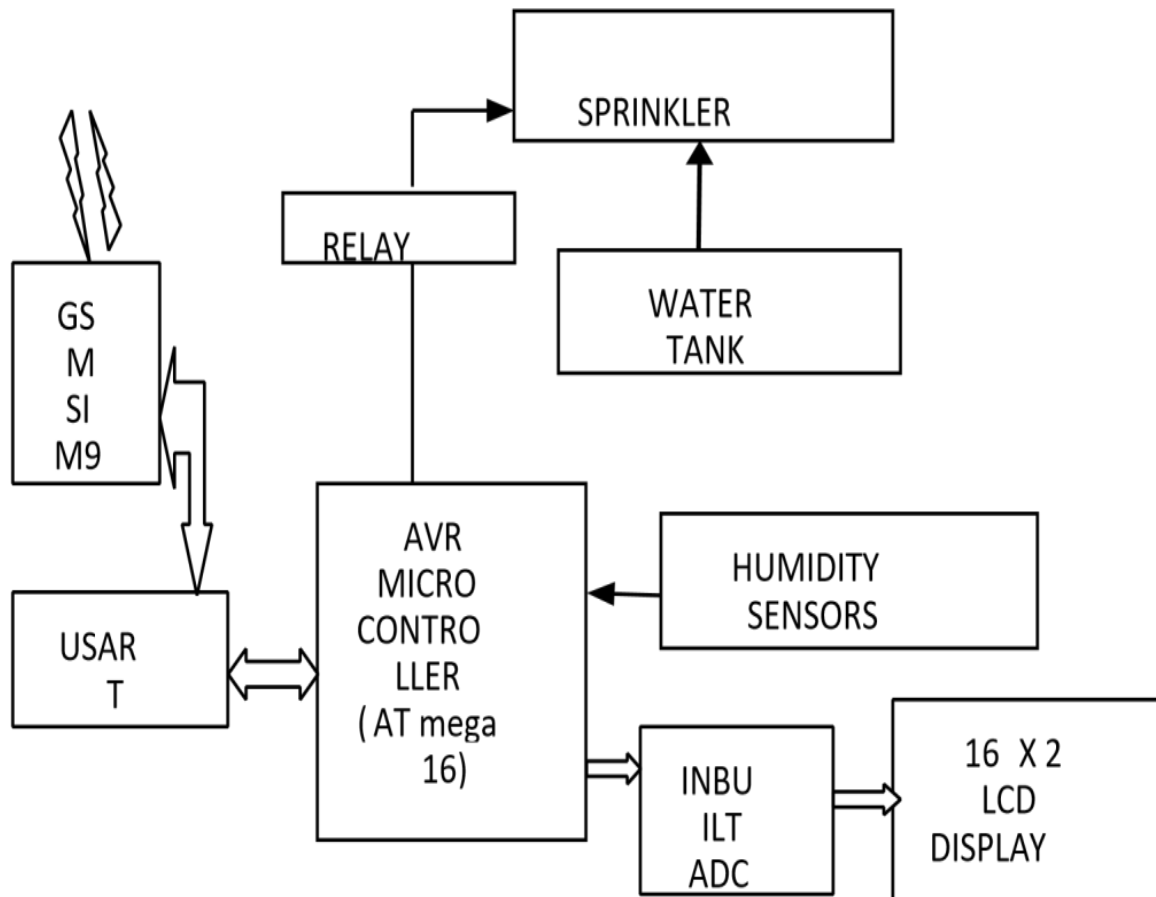


Fig:2.8 : Interfacing of electronic components [8].

2.9 MULTIPURPOSE AUTONOMOUS AGRICULTURAL ROBOT

The research and design of a robot used for ploughing, sowing, levelling, and watering on land are covered in the essay written by K. Durga Sowjanya et al. This machine is in charge of preparing the ground, planting seeds, plugging holes, and informing the user through a Bluetooth application.

The suggested device includes a four-wheeled chassis and runs on a 12V battery for power. A leveller is used to flatten the soil, a cultivator powered by a DC motor is used to dig up the dirt, and a water sprayer is used to irrigate the soil. The entire process is managed by the Bluetooth module and application on a smartphone.

The AT89S52 microcontroller, which serves as the system's brain, is the device employed in it. For the purpose of carrying out and switching between different tasks, the microcontroller is interfaced with DC motors, Bluetooth modules, and relays. Other factors including torque, speed, distance, the quantity of seeds

planted, and the amount of time are also noted. The block diagram of the complete procedure and the connections created in the robot are shown in Fig:2.9.

This system's main objective is to offer appropriate irrigation and harvesting, which can help farmers turn a profit on their crops.

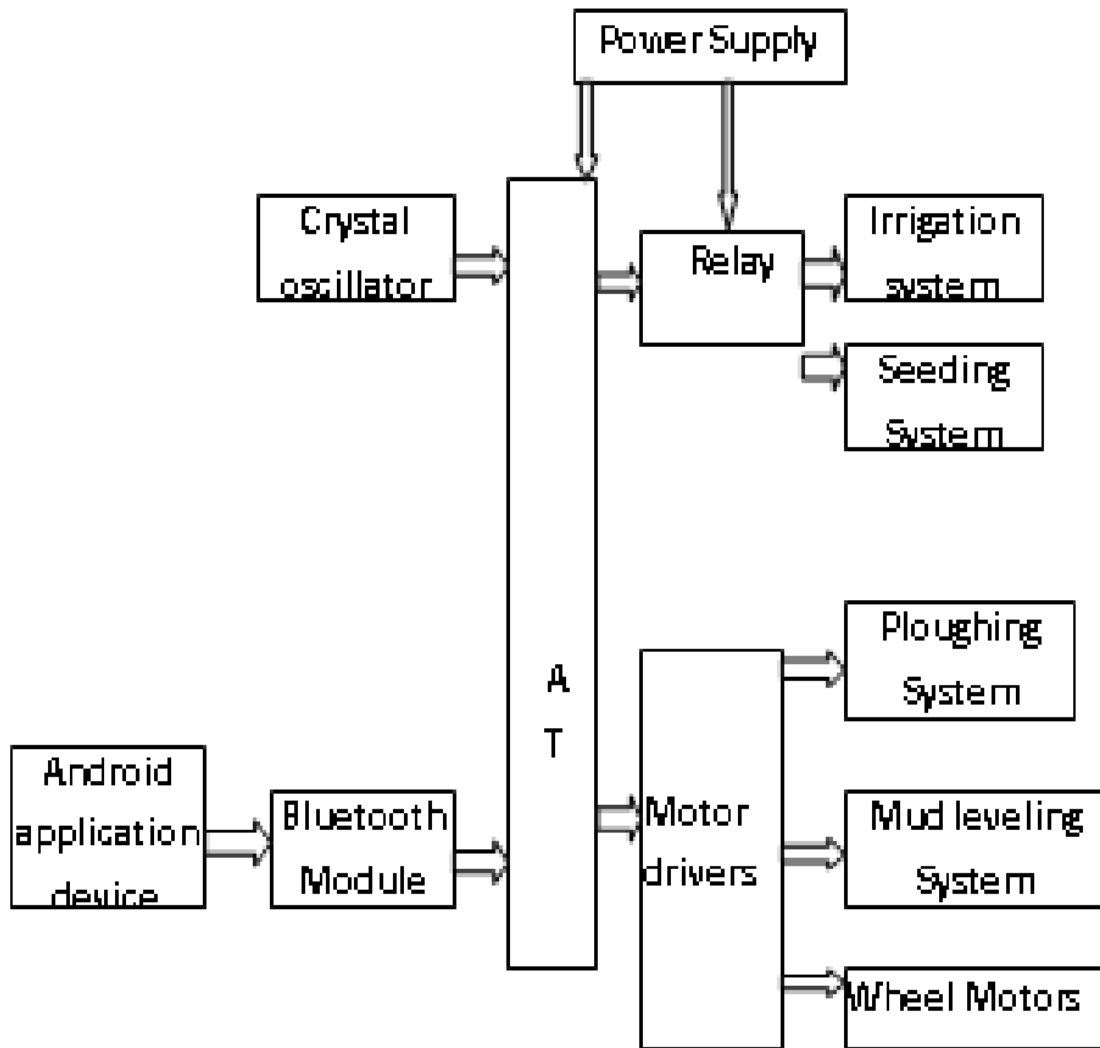


Fig:2.9 : Block diagram of Multipurpose Agricultural robot [9]

2.10 REVIEW: AUTONOMOUS AGRIBOT FOR SMART FARMING

This paper focuses on the limitations and difficulties of introducing automation in the agriculture sector and proposes an automated seeding and spraying system that eliminates the need for manual labour. The many kinds of microcontrollers that may be utilised for the system are also covered.

The suggested system includes an image processor, IR sensors, and a robotic arm to carry out the tasks. The controller is chosen depending on requirements such as

memory capacity and the quantity of needed input/output (digital/analog) devices. According on these specifications, controllers like the ATMEEL 8051, PIC, and Arduino are taken into consideration. While the ARM processor has an ADC interface and does not require external fitting, the ATMEEL 8051 does not, which might result in resource waste in a system with limited resources. In contrast, Arduino has 16 analogue input pins and 54 input/output pins. While choosing a microcontroller for the suggested system, pricing is another crucial factor.

2.11 COMPUTERS AND ELECTRONICS IN AGRICULTURE

The main goal of the study is to provide a vision-based system for under-canopy navigation that makes use of a Time-of-Flight (ToF) camera. Based on depth photos acquired under the plant canopy, the system uses a special algorithm to identify parallel rows of plants. In recent years, navigation in crop fields has seen a rise in the usage of artificial vision-based methods. Crop rows are detected by the system using vision sensors because they frequently exhibit consistently spaced, parallel, and straight line patterns. Row detection technique outputs are used for both robot localization and field mapping.

PhenoBot 3.0:

A ground mobile robot called PhenoBot 3.0 is intended to gather thorough phenotypic data for maize and sorghum plants at an agronomic row spacing of 0.76 m. The robot can photograph multiple organ-level features, including the roots, stems, leaves, and ears or panicles of maize and sorghum plants at various growth stages since it is outfitted with a self-balancing sensor mast and a bank of stereoscopic cameras. The motorised camera and telescoping mast on the robot enable simultaneous picture acquisition from various heights. The newly created Astereo camera module enhances image quality even further in dynamic outdoor lighting situations. Using maize photos gathered in various locations and situations, including plant development phases, weed infestation, and soil, the row identification algorithm's precision was tested. Crop damage is avoided and image quality is guaranteed thanks to the robot's ability to balance itself. The actuators and camera unit are put on the Phenobot 3.0 in Fig:2.10.



Fig:2.10 : PhenoBot 3.0 [11].

2.12 SAFETY AND ERGONOMICS IN HUMAN-ROBOT INTERACTIVE AGRICULTURAL OPERATIONS

The advantages of integrating the power and precision of robots in agriculture with the cognitive human traits of perception, decision-making, and action are highlighted by Lefteris Benos et al. in their study [12]. Cobots, or collaborative robots, are a natural development that may be able to overcome difficulties in jobs like pick-and-place, packing, and assembly in agriculture. Such systems should be designed with a focus on particular agricultural activities, employees, robots, and their interactions. The autonomy of the robot and the proximity of human-robot collaboration determine the degree of interaction between humans and robots.

A crucial factor that must be taken into account while designing collaborative robotic systems is occupational safety. The goal of occupational safety and health programmes is to provide a safe and healthy work environment within the bounds of the law. Physical contact detection between humans and robots is essential, and it is listed in (ISO, 2016) as one of the criteria for collaborative robotic systems. Furthermore, effective prediction systems depend on accurate face detection and identification as well as reliable human motion, gestures, activities, and facial expressions. Assessment of the ergonomic risk factors is essential to preventing musculoskeletal illnesses.

The authors stress that there is still more work to be done in order to create a secure human-robot interaction system (HRIS). Prioritizing safety measures, setting realistic boundaries, identifying risky postures, and raising risk factor awareness all require a unified strategy. Doctors and ergonomists are essential to this procedure. The development of a secure HRIS has advantages for societal, technological, and economic factors.

CHAPTER 3

AIM AND SCOPE

3.1 AIM

To develop and fabricate an eco-bot (agriculture robot) for pest control and soil monitoring using computer vision technology.

3.2 OBJECTIVES

- Create a computer vision system capable of reliably identifying and locating pests in a pheromone trap.
- Create an autonomous navigation system for the robot that can safely and efficiently navigate the environment.
- Create a system for identifying and avoiding impediments that the robot may encounter in its environment.
- Create and install an efficient pest extermination algorithm for the robot that can locate and eliminate pests accurately and fast.
- Create a system for collecting data on the environment and pests that can then be analysed and optimised.
- Create an effective communication system between the robot and its operator that allows for remote control and monitoring.
- Create a system that allows the robot to recognise and respond to external cues.

3.3 PROBLEM STATEMENT

Agriculture is the principal occupation of more than 40% of the world's population. Feeding the world's expanding population necessitates a yearly rise in food output. This demand implies a rise in pesticide use, which would imply an unsustainable chemical load on the ecosystem. Pesticide use reduction in agriculture has been a key goal in recent decades.

Pest control, or keeping nuisance creatures below economic thresholds, is a complex biological process that is frequently mediated by biodiversity. Agricultural intensification causes extensive biodiversity loss, which has serious implications for pest control.

Pests are kept at bay in agriculture using mechanical, cultural, chemical, and biological approaches. Ploughing and cultivating the soil before sowing lessen pest burden, and crop rotation helps to limit pest species buildup. Concern for the environment necessitates a reduction in pesticide use in favour of other methods.

3.4 DRAWBACKS

- Required long term planning for greatest effectiveness and they need careful timing.
- Enormous of pesticide's causes poisoning corps and damage humane health.

CHAPTER 4

WORKING AND METHODOLOGY

4.1 METHODOLOGY

This project works based on computer vision technique to control the pest in agriculture. Where delta trap is used to attract the insects and by using computer vision the image has capture through the camera module and convert the raw image into binary image to process the operation. after the image processing, microprocessor gives signal to the rover to move forward. While moving forward UV sensor guide to avoid abstract and motor pump was used to spray fertilizer on the field.

4.2 WORK FLOW

- System Design: Design the system architecture for a pest control robot, including the hardware and software components needed to enable computer vision.
- Image Acquisition: Select the appropriate camera and sensor array required to acquire images of the environment, as well as any additional data such as temperature, humidity, etc.
- Image Processing: Develop algorithms for image pre-processing, feature extraction, object detection and tracking.
- Path Planning and Navigation: Develop algorithms for path planning, obstacle avoidance and navigation.
- Control: Design control algorithms for the robot to detect and respond to the environment and to control its motion.
- Evaluation: Test the robot in real-world conditions and evaluate the performance of the system.

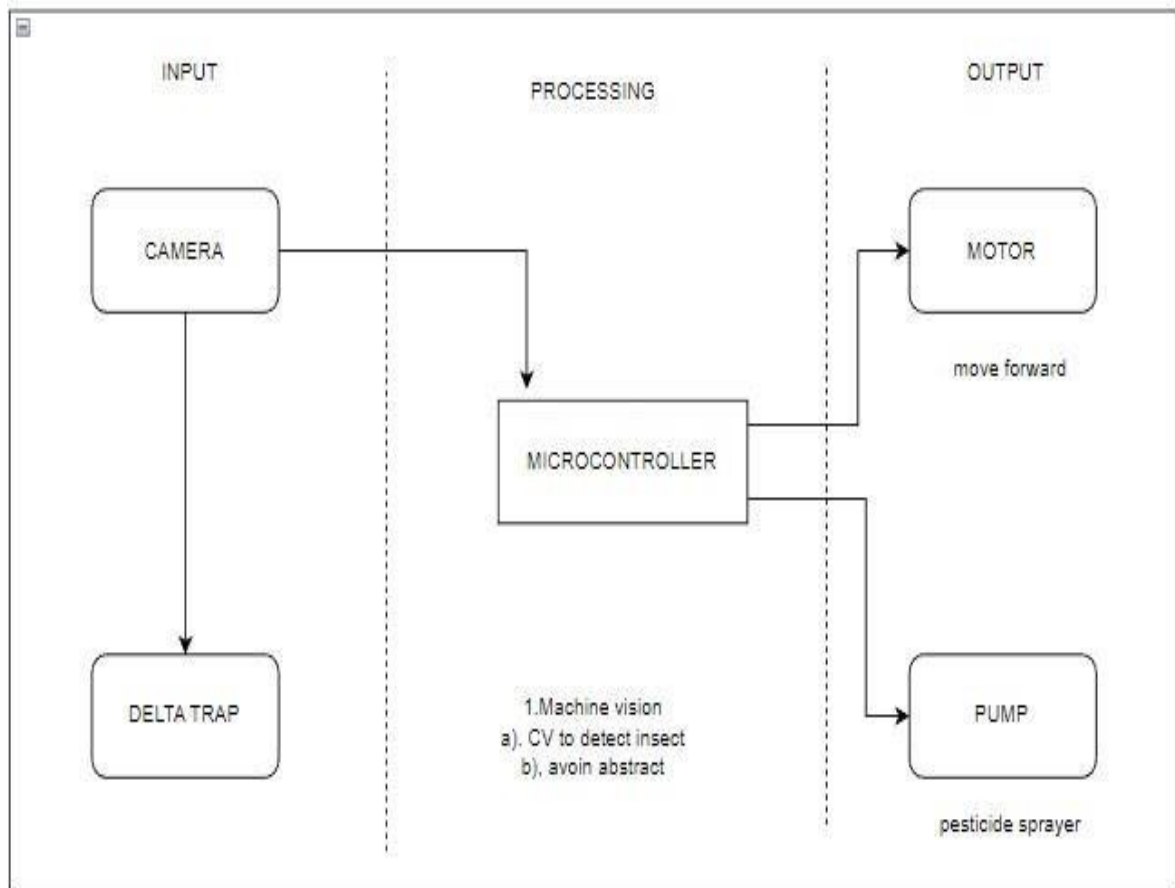


Fig: 4.1 : Flowchart of the methodology

4.3 COMPONENTS USED IN DEVELOPMENT OF ROVER

Components used in the project are:

- Raspberry pi 3A.
- Camera module
- Phenomenon trap.
- 12V DC motors.
- Battery 12v & 9v.
- Water pump.
- Water sprayer
- Ultrasonic sensor
- Chassis
- Reservoir.
- Accelerometer.
- Motor Drive.

4.3.1 Raspberry Pi 3A

The Raspberry Pi 3 Model A showed in a figure 4.2, was released in February 2016 and features a 1.2 GHz 64-bit quad core ARM Cortex-A53 processor, integrated 802.11n Wi-Fi, Bluetooth, and USB boot capabilities.

The Raspberry Pi 3 Model B+ was announced on Pi Day 2018 with a faster 1.4 GHz processor, three times faster gigabit ethernet (throughput limited to roughly 300 Mbit/s by the internal USB 2.0 connection), and 2.4 / 5 GHz dual-band 802.11ac Wi-Fi (100 Mbit/s). Additional capabilities include USB boot, network boot, and PoE (with the PoE HAT add-on). (An SD card is no longer required).



Fig:4.2 : Raspberry Pi 3 A

4.3.2 Camera Module ESP 32

The ESP32CAM is a module built around the ESP32 microprocessor and the OV2640 showed in a figure 4.3. By installing the ESP32 Core, the ESP32CAM may be programmed using ESP-IDF.

The module is equipped with everything that is needed for programming. The module is further integrated with MPU6050 that acts as gyroscope and accelerometer that allows for measurement of rotation and speed in all three axes. It also has slots for BME280 which is a humidity sensor that also measures humidity and temperature. in all three axes. It also has slots for BME280 which is a humidity sensor that also measures humidity and temperature.



Fig:4.3 : ESP32CAM Module

4.3.3 Pheromone Trap

A pheromone trap is a type of insect trap that attracts insects via pheromones. Pheromone traps are extremely sensitive, attracting insects even at very low densities. This trap is used to detect the presence of pests so that further pest-control measures can be implemented. The pheromone trap serves as a bait as well as an indicator of insect presence. Figure 4.4 is a pheromone trap used to attract insects.



Fig:4.4 : Pheromone Trap

4.3.4 Motor

The motor in figure 4.5 used is a 12-volt motor that produces an output of 300 RPM .The torque output is about 1.9 kg/cm. Six of these motors are connected to the wheels of the rover that provide movement the rover. The sidewise movement is provided by partial change in speed of the wheels on one side. The motor is connected to a battery source.



Fig:4.5 : 12V DC motor

4.3.5 Wheels

The wheels in figure 4.6 connected to the motor are of 85mm diameter x 38mm wide. The wheels are a combination of rubber and plastic. The rubber outer provides with friction for road grip whereas the high strength plastic is connected to motor that provides the needed torque. The high strength plastic can handle the torque provided from the motor.



Fig:4.6 : Wheels

4.3.6 Water Pump

The water pump is a 12 Volt DC submersible water pump that is used to pump water/pesticide. The maximum flow is about 10 litres per minute. The operating power is 8 Watts. The water pump in figure 4.7 pumps the water from the reservoir to the sprayer.



Fig:4.7 : Water Pump

4.3.7 Water Sprayer

A water sprayer in figure 4.8 is used to turn solution which is in liquid form to aerosol form. The water sprayer is operated by a 12-Volt DC motor. It has an operating pressure of 110 PSI. The maximum flow is 4.5 litres per minute. The hose pipe has an internal diameter of 8mm and 12mm external diameter. It is connected to the pump which send fluid and the sprayer turns it into aerosol form.



Fig:4.8 : Water Sprayer

4.3.8 Water Reservoir

A reservoir in figure 4.9 is a container that holds any solution to be used. The reservoir is a plastic encasing that is connected to the pump and then into to the sprayer. The capacity of the is 16 litres. Pressurizing lever helps to aerosolize the solution.



Fig:4.9 : Water reservoir

4.3.9 Frame

The rover frame is made of metal that encases all the components.

4.3.10 Battery

A power supply is a type of electrical device that provides energy to a load. A power supply's primary job is to convert electric current from a source to the voltage, current, and frequency required to power a load. AC and DC are the two forms of power sources. Typically, AC from a wall outlet is converted to unregulated DC, which is then stepped down to the voltage required by the load through an input power transformer. For safety reasons, the transformer also separates the output power supply from the primary input. One of the most common methods for obtaining results in flaw detection testing is to employ a power source. Test points that use a power supply are more sensitive to signal fluctuations caused by errors and less intrusive than points in the core logic. The power source is a 12 Volt battery. The battery showed in figure 4.10 is connected

to all other components that need power supply. The battery is a lead acetate battery. It has a discharge of 25 ampere.

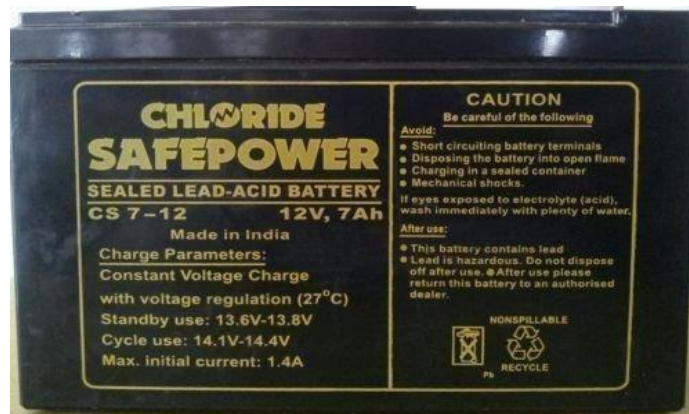


Fig:4.10 : 12V Battery

4.3.11 Motor Drive

A motor drive in figure 4.11 is a method for adjusting and varying the speed of a motor. A variable speed motor drive is a system that incorporates a motor with a speed that is continuously variable. If the motor generates rather than consumes electrical energy, this is referred to as a generator drive, however it is more commonly referred to as a motor drive. The electrical element of the system that controls the speed of the motor is referred to as a Variable Frequency Drive (VFD) or Variable Speed Drive (VSD).

L298 is the motor drive used. With the L298 twin H-Bridge chip put on this convenient breakout board, it is a 2-phase bipolar stepper motor or two DC motors. It is perfect for robotic applications and may be connected to a microcontroller with only a few control lines per motor. It can also be linked to basic manual switches.



Fig:4.11 : Motor drive (VFD)

4.3.12 Relay Module

A power relay module in figure 4.12 is an electromagnetically driven electrical switch. A separate low-power signal from a microcontroller activates the electromagnet. The electromagnet pulls to open or close an electrical circuit when energised. Two relay boards with four channels each are utilised to relay electricity to various components.



Fig:4.12 : Relay module

4.3.13 Jump Wire

A jump wire in figure 4.13 is an electrical wire, or group of wires in a cable, with a connector or pin at each end that is typically used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering. Individual jump wires are connected by putting their "end connectors" into slots supplied on a breadboard, a circuit board's header connector, or a piece of test equipment.



Fig:4.13 : Jump wires

4.3.14 Ultrasonic Sensor

An ultrasonic sensor in figure 4.14, is an electronic device that uses ultrasonic sound waves to detect the distance between two objects and converts the reflected sound into an electrical signal. Ultrasonic waves travel quicker than audible sound waves. The transmitter and receiver are the two primary components of ultrasonic sensors. The ultrasound sensor used is HC-SR04. The operating voltage is 5 voltages. The sensing range is 400-450 cm. The frequency is 40 kHz.



Fig:4.14 : Ultrasonic sensor

4.3.15 WIFI MODULE

ESP8266 in figure 4.15 is the WiFi module utilised. The ESP8266 WiFi Module is a self-contained SOC with an inbuilt TCP/IP protocol stack that can provide connectivity to a WiFi network to any microcontroller. The ESP8266 may host applications or offload all WiFi networking tasks from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, allowing it to be connected to an Arduino device and provide roughly the same WiFi functionality as a WiFi Shield. The ESP8266 supports APSD for VoIP applications and Bluetooth coexistence interfaces, and it has a self-calibrated RF that allows it to work in all operational situations with no extra RF parts.

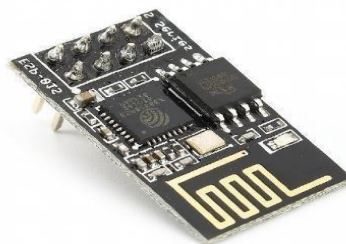


Fig:4.15 : ESP8266 WIFI module.

CHAPTER 5

RESULT AND DISCUSSION

5.1 RESULT

Testing of computer vision is succeeded and worked well by detecting the insects. In this demonstration Arduino was programmed to convert the signal into readable program. The image processing was done by detecting the insects by the camera module and data has been collected.

- Computer vision has been tested.
- Fabrication work has been completed.

5.2 WORKING

The computer vision rover for pest control and soil monitoring is intended to operate in agricultural fields and collect real-time data on soil conditions and pest populations. The rover is outfitted with sensors and computer vision technology to navigate the field, detect pests, and monitor soil conditions.

The working of the rover can be broken down into several steps:

Pest detection: The rover has computer vision technology that detects and identifies pests in the field. The computer vision algorithms analyse the sensor data to identify pests and determine their location and population.

Soil monitoring: The rover also has sensors that can monitor soil conditions like moisture, nutrient content, and pH levels. The sensors gather data and send it to the computer vision system, which processes the information and provides real-time feedback on soil conditions.

Data collection and analysis: The rover collects information on pest populations and soil conditions, which it sends to a central database for analysis. The information can be used to improve pest control strategies and soil management practises.

Control system: The rover has a control system that responds to sensor feedback and computer vision technology. Based on feedback from the sensors and computer vision system, the control system adjusts the rover's movement and sensor data collection.

In summary, the computer vision rover for pest control and soil monitoring is an autonomous system designed to navigate agricultural fields, detect pests, and monitor soil conditions. The rover's real-time data can be used to develop more effective pest control strategies and optimise soil management practises, resulting in increased agricultural productivity and sustainability.

5.3 CODE FOR COMPUTER VISION

```
previous_frame = None
```

```
while True:
```

```
    img_brg = np.array(ImageGrab.grab())    img_rgb = cv2.cvtColor(src=img_brg,  
code=cv2.COLOR_BGR2RGB)
```

```
    prepared_frame = cv2.cvtColor(img_rgb, cv2.COLOR_BGR2GRAY)  
    prepared_frame = cv2.GaussianBlur(src=prepared_frame, ksize=(5, 5),  
sigmaX=0)
```

```
    if (previous_frame is None):
```

```
        previous_frame = prepared_frame        continue
```

```
diff_frame = cv2.absdiff(src1=previous_frame, src2=prepared_frame)
previous_frame = prepared_frame
```

```
kernel = np.ones((5, 5)) diff_frame = cv2.dilate(diff_frame,
kernel, 1) thresh_frame =
cv2.threshold(src=diff_frame, thresh=20, maxval=255,
type=cv2.THRESH_BINARY)[1]
```

```
contours, _ = cv2.findContours(image=thresh_frame,
mode=cv2.RETR_EXTERNAL, method=cv2.CHAIN_APPROX_SIMPLE)
```

```
cv2.drawContours(image=img_rgb, contours=contours, contourIdx=-1, color=(0,
255, 0), thickness=2, lineType=cv2.LINE_AA)
```

```
cv2.imshow('Motion detector',
img_rgb) if (cv2.waitKey(30) == 27):
break
```

```
cv2.destroyAllWindows()
```

5.4 IMAGE PROCESSING OUTPUT

Fig 5.1, for their computer vision project, used an online source video as a starting point for their research. Online videos can provide a wide range of content to work with, making it easier for researchers to find footage that meets their specific needs. By using online sources, Fig 26 could save time and resources that would have been spent recording and processing their own footage. However, it's important to ensure that the sample video used is appropriate and relevant to the project. It's also crucial to adhere to any necessary legal requirements, such as checking the license and attribution requirements to avoid copyright infringement. By carefully selecting and utilizing online source videos, researchers like Fig 26 can take

advantage of the vast amounts of digital content available to enhance their computer vision projects.



Fig:5.1 : Original frame

Fig 5.2 was able to process an algorithm image from the sample video using computer vision techniques. By applying algorithms to the sample video, Fig 27 could extract and analyse visual data to uncover patterns and insights that might not be immediately visible to the human eye. This process can be incredibly useful for a wide range of applications, from object recognition and motion tracking to facial recognition and autonomous driving. However, the accuracy and reliability of algorithmic image processing depend on many factors, such as the quality and resolution of the input data and the specific algorithms used. As such, it's essential

to carefully design and test algorithms to ensure their effectiveness and reliability. Despite the challenges, computer vision techniques like those employed by Fig 27 have enormous potential to unlock new insights and capabilities in a wide range of fields.

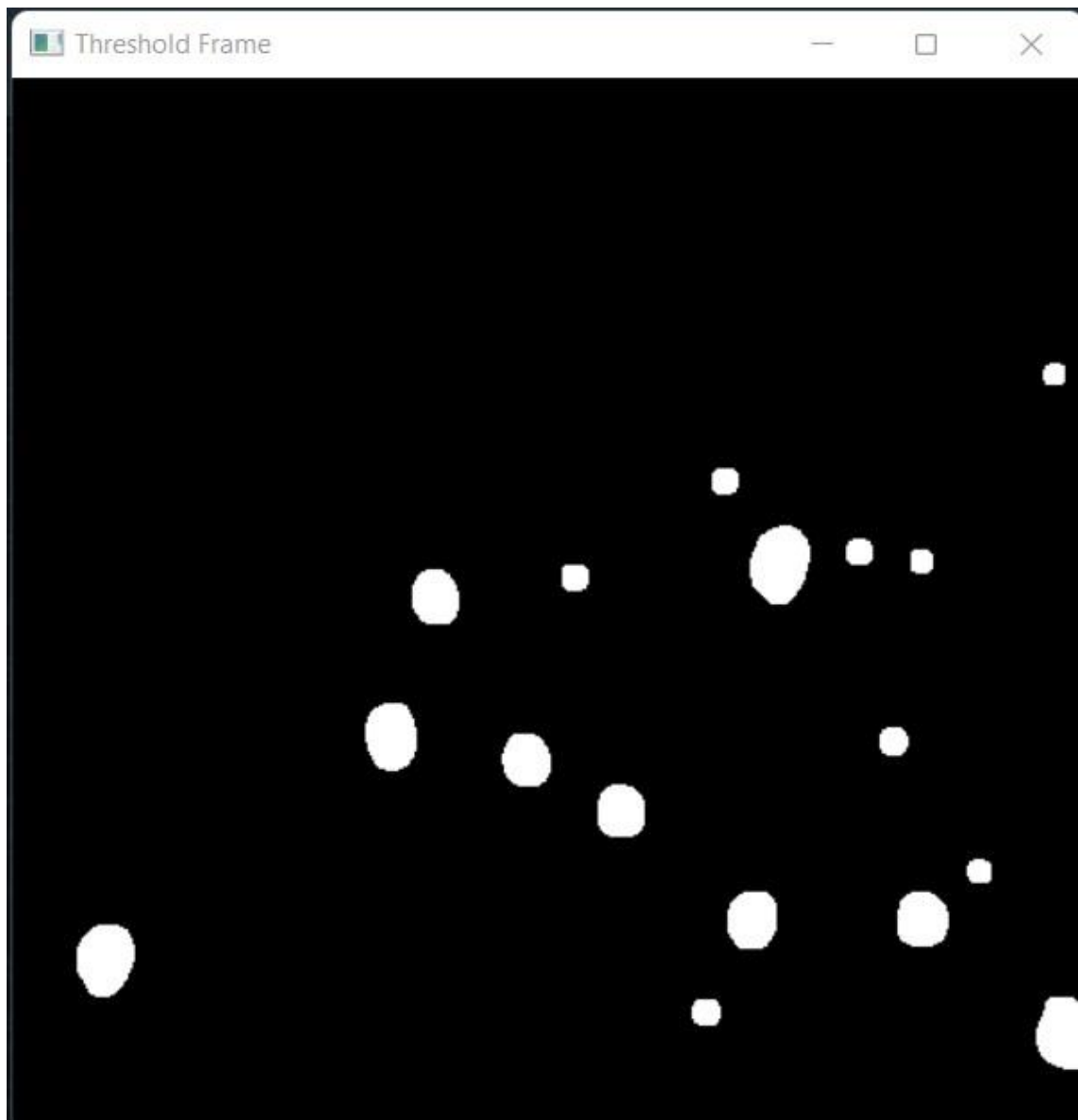


Fig:5.2 : Processed Image

Fig 5.3 is a final image that depicts a computer process using a jumper box for detecting insects. The image showcases a complex system that involves multiple components, including the computer, the jumper box, and various other tools and devices. The process involves using the jumper box to send electrical signals into a specific area, which can detect the presence of insects. This method is widely

used in entomology research and is especially useful for detecting small insects that might be difficult to see or identify with the naked eye. The final image is a testament to the complexity and sophistication of modern technology and its application in the field of science. It highlights the incredible advances that have been made in recent years and the exciting possibilities that lie ahead for further exploration and innovation

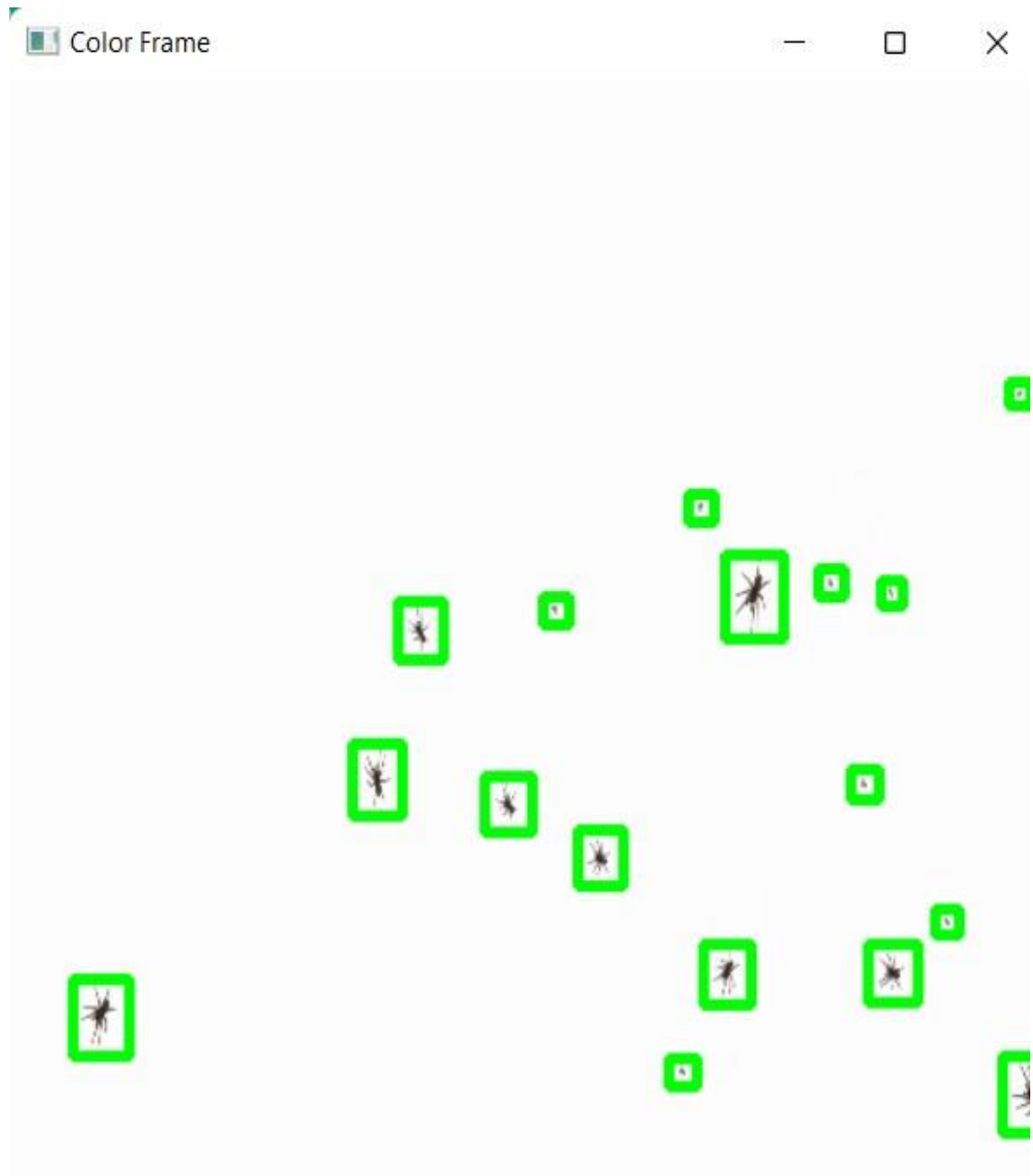


Fig:5.3 : Colour frame

5.5 DESIGN OF THE ROVER

The rover was designed to move on the agriculture land. The design on the rover was inspired by rhino beetle. One of the key advantages of rhino beetle-inspired all-terrain rover is its ability to improve farming efficiency and productivity. By being able to traverse any terrain, it can access parts of the farm that may have been difficult to reach before. This allows for more thorough and efficient farming practices, which can lead to increased yields and profits. Additionally, the rover's specialized tools and features can assist in a variety of agricultural tasks, from soil preparation to planting and harvesting. the following figures are the different dimensions of the rover showed with the rover taking on some of the workload, farmers can focus on other important tasks or even expand their operations. The rover's durability and flexibility also mean that it can withstand harsh weather conditions and adapt to changing farming needs. Overall, your rover has the potential to make a significant impact in the agricultural industry, improving farming practices and ultimately contributing to global food security.



Fig:5.4 : angular view of rover

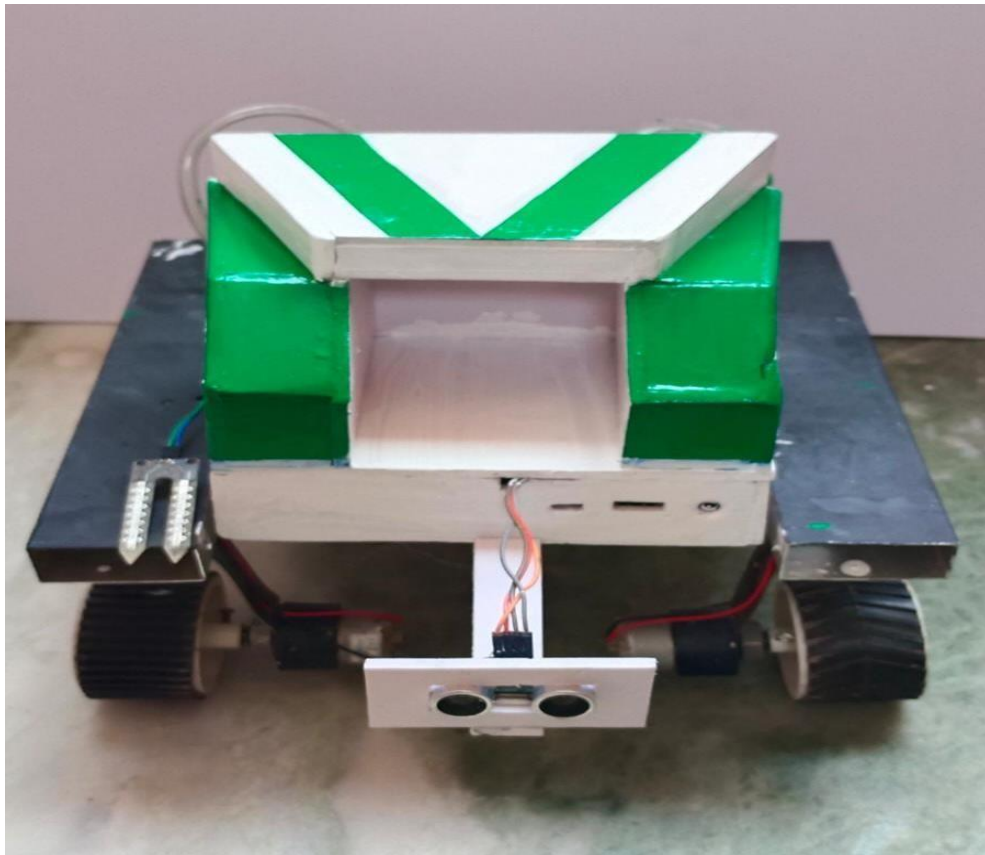


Fig:5.5 : front view of the rover



Fig:5.6 : Top view of the rover



Fig:5.7 : Isometric view of the rover

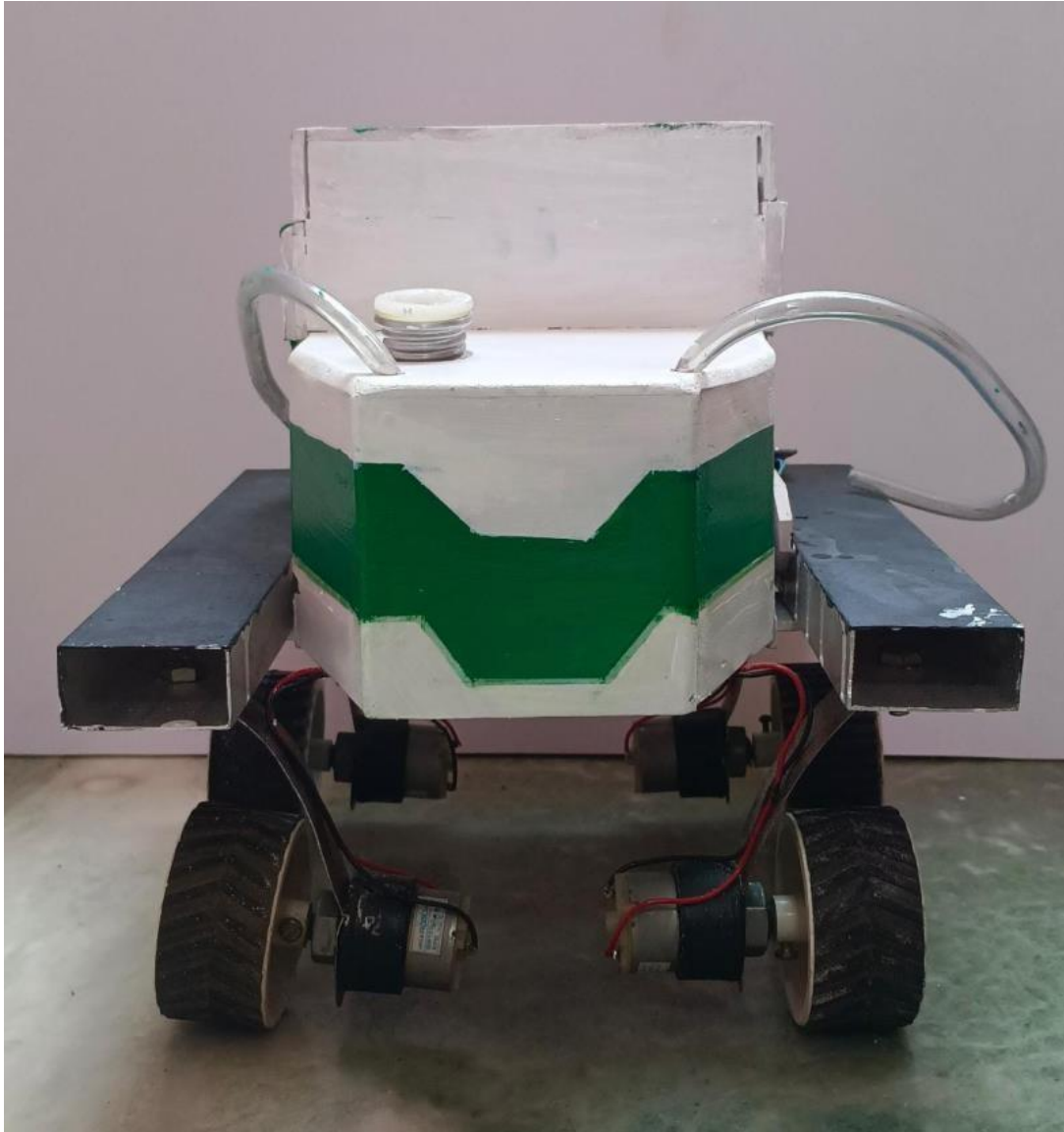


Fig:5.8 : Back view of the rover

Various views such as angular view, top view, side view, front view and other views are mentioned in the above images (Fig:5.4, Fig:5.5, Fig:5.6, Fig:5.7, Fig:5.8). The above image helps in understanding the fabrication, design and function of the rover. As seen in the above image the ultrasonic sensor is mounted on the pole to determine the distance between the rover and obstacles such as plants, objects or wall. The frame/chassis, wheel, driving motors, housing and sprayer system can be viewed in the above images.

5.6 TABULATION

IMAGE OF THE INSECTS	INSECT CODE	SIZE OF THE DISTANCE MEASURED	MOISTURE CONTENT OF SURROUNDING
	INSECT 1	57 mm	0.048
	INSECT 2	57mm	0.048
	INSECT 3	57mm	0.048

	INSECT 4	57mm	0.048
---	----------	------	-------

5.7 OUTPUT

```
[0]
Mois=0.04885197850512668

*IIII0000#
0
0
0
0
Measured Distance = 6.1 cm
[[0.9991736 0.00001463 0.00002386 0.00043338 0.00035465]]
```

Fig:5.9 : output for insect 2

The Fig:5.9 is the output frame of insect 2 which have the measuring distance of 6.1 cm and moisture value of 0.048

```

Insect 1
[1]
Mois=0.04885197850512668

*IIII1000#
1
0
0
0
Measured Distance = 57.0 cm
[[0.00035476 0.9859035 0.00359482 0.0019443 0.00820265]]

```

Fig:5.10 : output for insect 1

The Fig:5.10 is the output frame of insect 1 which have the measuring distance of 5.7 cm and moisture value of 0.048

```

[[0.00036296 0.00105817 0.00261525 0.00097143 0.9949922 ]]
Insect 4
[4]
Mois=0.04885197850512668

*IIII1000#
1
0
0
0
Measured Distance = 57.0 cm
[[0.00032699 0.00091766 0.00195446 0.00066851 0.9961324 ]]

```

Fig:5.11 : output for insect 4

The Fig:5.11 is the output frame of insect 4 which have the measuring distance of 5.7 cm and moisture value of 0.048

```

[[0.02599627 0.02023339 0.09289911 0.7440507 0.11682055]]
Insect 3
[3]
Mois=0.04885197850512668

*IIII1000#
1
0
0
0
Measured Distance = 57.0 cm
[[0.0233393 0.02728758 0.07763895 0.7200981 0.15163611]]
Insect 3

```

Fig:5.12 : output for insect 3

The Fig:5.12 is the output frame of insect 3 which have the measuring distance of 5.7 cm and moisture value of 0.048

CHAPTER 6

CONCLUSION

6.1 SUMMARY

The proposed agriculture robot was tested with plants in a greenhouse environment. The robot was able to capture images and detect insects on the delta trap. The results show that the proposed robot has the potential to assist farmers in more efficiently monitoring their crops and detecting diseases at an early stage. Farmers may find the proposed agriculture robot to be a useful tool. The robot can help prevent crop loss and increase crop yields by monitoring crops more efficiently and detecting insects. The robot can also assist farmers in making informed crop management decisions by providing real-time data on environmental conditions.

The results of the rover's development and fabrication demonstrated that the system was capable of detecting insects in the environment. The system could also detect and avoid obstacles, as well as detect and identify objects in the environment. This indicates that the system is capable of carrying out the tasks for which it was designed.

The use of computer vision for pest control and soil monitoring is a promising technology, as demonstrated by this study. The results also show that the rover's design and fabrication were successful, and that the system can be used.

6.2 CONCLUSION

To summarise, the design and construction of a rover for pest control and soil monitoring using computer vision is a promising area of research with numerous potential benefits. The use of a rover outfitted with sensors and computer vision technology can provide a more efficient and effective method of pest management and soil condition monitoring. The rover's real-time data can be used to develop more effective pest control strategies and optimise soil management practises. However, developing such a rover presents several challenges, including designing a rover that can traverse different terrains and withstand various weather conditions. Furthermore, the rover must be outfitted with the necessary sensors and computer vision technology to detect and identify pests as well as monitor soil

conditions. It must also be user friendly, simple to operate and maintain, so that it can be used by farmers and other individuals who may lack extensive technical knowledge.

The advantages of such a rover are numerous. It has the potential to provide a more environmentally friendly method of pest and soil management, reducing the need for harmful chemicals and interventions. It can also provide more accurate and real-time data, resulting in more effective decision-making and increased productivity. Overall, the design and construction of a rover for pest control and soil monitoring using computer vision is an interesting area to investigate. With additional research and development, the technology has the potential to revolutionise pest control and soil monitoring, as well as improve agricultural productivity.

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ANNEXURE:

- Review Paper on the title of “A review on Different Robots and Technologies used in Agriculture” by Kishaan B.S., Nishanth Kumar. R and Dr.Sangeetha. M has been presented in ICAARS conference conducted by PSG College, Coimbatore on 10th December, 2022.
- Review Paper on the title of “A review on Different Robots and Technologies used in Agriculture” by Kishaan B.S., Nishanth Kumar. R and Sangeetha has been presented in ICMMSE conference conducted by Sri Venkateswara College of Engineering and Technology, Chittoor, Andhra Pradesh on 30th December, 2022.
- Review Paper has been communicated to AIP Conference Proceedings Journal.
- Research paper on the title of “Development and Fabrication of Rover for Pest Control and Soil Monitoring Using Computer Vision” by Nishanth Kumar. R, Kishaan B.S., Sangeetha. M has been presented in ICDTM conference conducted by Sastra University, Thanjavur on 9th April, 2023.



4th International Conference on
Manufacturing, Material Science & Engineering
30th & 31st December, 2022



Date 10/12/2022,

To,
Mr.R. Nishanth Kumar
Sathyabama Institute of Science and Technology(Deemed to be university)
Chennai-600119

Dear Author,

It is our pleasure to inform you that your paper entitled “A Review of Different Robots and Technologies Used in Agriculture (Paper Id: AIP-118)” has been provisionally accepted for Virtual oral paper presentation at ICMMSSE-2022 on 30th and 31st December 2022 and also we will publish paper in AIP(Scopus indexed journal).The publication process takes 3 to 4months time.

Thanks and Regards,

Dr. B Sridhar Babu,
Convener,
SVCET, Chittoor



4th International Conference on
Manufacturing, Material Science & Engineering
30th & 31st December, 2022



CERTIFICATE OF PRESENTATION

This certificate is awarded to **Prof./Dr./Mr./Ms R Nishanth Kumar, Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu, India**, for participating and presenting a paper titled **A Review of different robots and technologies used in agriculture** in 4th International conference on Manufacturing, Material science & Engineering organized by Department of Mechanical Engineering, Sri Venkateswara College of Engineering and Technology, Chittoor, Andhrapradesh, India. During 30th & 31st December 2022.

Dr. B Sridhar Babu
Convener, ICMMSE
SVCET

Dr. V. Harinadh
HOD, Dept of Mechanical Engg
SVCET

Dr. M. Mohan Babu
Principal
SVCET



Department of Robotics and Automation Engineering

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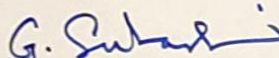
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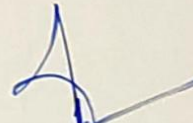


**Third International Conference on
Advancements in Automation, Robotics & Sensing
(ICAARS - 2022)**

CERTIFICATE

This is to certify that Dr./Mr./Mrs./Ms. Kishan B.S. has presented
a paper in the technical session on 10.12.2022 entitled A Review of Different
Robots and Technologies Used in Agriculture in the **Third**
International Conference on Advancements in Automation, Robotics and Sensing
(ICAARS 2022) organised by the Department of Robotics and Automation Engineering, PSG College
of Technology, Coimbatore during 9-10 December 2022.


Dr. G. Subashini
Organizing Secretary


Dr. B. Vinod
Convener

A Review of Different Robots and Technologies Used in Agriculture

NISHANTH KUMAR.R ^{1, a)}, KISHAAN B.S. ^{1, b)}, SANGEETHA.M ^{1,c)}

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Abstract: About 40% of people on the planet make their living through agriculture. A significant player in the economy is agriculture. Around the world, agricultural automation is a significant and developing subject. This review gives a broad overview of the research on various robot types and agricultural methods utilized for various activities. The major objective is to speed up planting and improve growth. This essay's major objective is to offer feasible solutions for lowering the usage of pesticides and other hazardous substances that can affect both people and plants. Digging and planting technical reviews and studies are accomplished. Different computer vision systems and models are studied to save time and effort. The use of computer vision for moving around a field and To reduce time and effort various computer vision systems and models are studied and analyzed. Computer vision may also be used for movement around the field and for various other purposes.

Keywords. Agricultural robots, machine vision, computer vision, sensors.

1. INTRODUCTION

Induction of robotics and automation in robotics will aid in developing new methods and strategies in tackling the problems faced in conventional farming. As automation increases in all fields of like, agriculture is mostly left behind in terms of automation. Hence automation is needed to provide increase in yield and quality. Many processes that are implemented in various sectors in industries can be implemented to provide new developments in farming. The main aim of automation is to reduce repetitive and labour-intensive tasks that are carried out by humans. This paper focuses on various agricultural robots and technologies that have been implemented in the agricultural industry. This paper further focuses on implementation of machine vision systems and computer vision system with agricultural robots. The multitasking/multipurpose robots perform many functions that are reduce work time and human labour.

2. EARLIER WORKS

2.1 A Multipurpose Robot for Tracking and Movement

This paper focuses on fabricating a multipurpose robot that tracks and moves based on the input given by sensor. The sensor system consists of a transmitter and receiver. IR LED is used to emit light that is received by the transmitter. The reflected light collected from the white line that acts as feedback system. Various other functions include spraying pesticides, planting seeds, ploughing and water supply. Pesticide and water is sprayed sing a DC motor and seeds are dispatched using a hopper that is connected to a stepper motor. The power source used is a solar panel that powers the system. Thus, from this research article the methodology of movement and tracking of a robot is studied.

2.2 Multipurpose Robot Using IOT

This paper focuses on fabricating a multipurpose robot for irrigation and real time field monitoring. The brains of the system are a Raspberry Pi microcontroller. Sensors such as temperature sensor, moisture sensor, humidity, camera are also connected to the microprocessor. The various inputs from the sensors are used provide feedback on the action to be taken. The power



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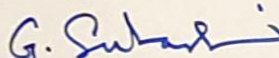
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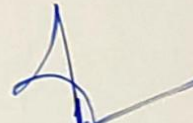


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DEVELOPMENT AND FABRICATION OF ROVER FOR PEST CONTROL AND SOIL MONITORING USING COMPUTER VISION

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ABSTRACT:

As automation increases in agriculture field, this project resulted in making a monitoring robot for agriculture field without human. The main purpose was to see how cultivation growth can be increased. By using sensors, today's technologies we can increase the growth and cultivation for better. This project designs a monitoring system to monitor the soil and insects using sensors and computer vision system. The use of Arduino as a micro controller-where electrical components could be programmed, became the control of all subsystems. Moisture sensor was used to detect the soil dryness and computer vision is used to detect the insects to spray fertiliser. By this when soil became dry sensor detect it and start spray water using motor pump and using computer vision, we detect the insects which attract to delta trap and spray fertilizer.

Due to the use of high fertilizer plant became poisoning by this project we can reduce the use of heavy fertilizer by detecting the insects. The system spray fertilizer if insect was detected by computer vision. And by detecting the soil we can spray the water at correct time to reduce the plant getting withered.

INTRODUCTION:

Pest control is a major issue for modern farmers and gardeners, as it can damage crops and cause financial losses. To address this problem, researchers have developed robotic systems that use computer vision to detect and eradicate pests. These

robots use cameras to identify the pest and then autonomously move towards it and spray it with pesticides to eliminate the pest. They are equipped with ultrasonic, infrared and other sensors to detect obstacles and navigate the environment. The robots can be programmed to patrol large areas and can be deployed both indoors and outdoors. Additionally, they can be used to monitor the area for pests, allowing farmers to take immediate action when a pest is spotted. This technology provides a more efficient and cost-effective way of controlling pests, and can greatly reduce the number of pesticides used, thus protecting the environment.

This project develops a computer vision system and sensor-based monitoring system for insects and soil. the ability to programme electrical components using an Arduino microcontroller, became the system in charge of each subsystem. In order to spray fertiliser, a moisture sensor was utilised to measure how dry the soil was, and computer vision is used to identify insects. . By this when soil became dry sensor detect it and start spray water using motor pump and using computer vision, we detect the insects which attract to delta trap and spray fertilizer. By detecting the insects, we may lessen the use of heavy fertiliser, which plants became poisoned by due to the use of high fertiliser. Insects spotted by computer vision are treated with fertiliser by the system. Additionally, we can spray the water at the appropriate time to prevent the plant from withering by detecting the soil.

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