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Solar Powered Multipurpose Agriculture Robot

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Abstract:- In India, more than 60 percent of the people works in agriculture as their main job. Due to a growing lack of workers, there is now more interest in developing robots and other self-driving cars for use in agriculture. A robot called a "agriculture robot" has been made to reduce the amount of work farmers have to do and to speed up and improve the quality of their work. The goal of the proposed system is to make a multipurpose autonomous agricultural robotic vehicle that can be controlled through Bluetooth. This vehicle could be used for sowing seeds, cutting grass, ploughing, detecting soil moisture, spraying pesticides, and detecting leaf diseases with a Raspberry Pi and suggesting what kind of pesticides should be used for that disease. Autonomous cars are used so that people don't have to do as much work. This leads to a higher yield and better use of resources.

Keywords: *Raspberry Pi, Arduino Uno Mini, Controllers, Solar Energy.*

I. INTRODUCTION

Agriculture is the backbone of India. India is now the world's second-largest agricultural product producer. The agricultural special vehicle field is gradually expanding its manufacturing. Growing input prices, a paucity of qualified workers, a scarcity of water resources, and crop monitoring are all critical challenges in India's agricultural economy. Automation technologies have been used in agriculture to address these concerns. The agricultural census provides critical information about the distribution of land ownership in our country.

According to the census, the majority of farmers hold less than one hectare of land. This is one of the most serious drawbacks of agricultural mechanisation in India. Vehicles are being built for a variety of operations, including ploughing, seed planting, levelling, water spraying, and grass cutting. These tasks have yet to be achieved with a single vehicle. The robots in this project are meant to focus effectively and do tasks independently. The proposed design employs a vehicle to do duties such sloughing, sowing, grass cutting, pesticide spraying, and detecting and recommending pesticides for leaf disease. These responsibilities are consolidated and carried out in a single vehicle. Farmers may reduce environmental impact, improve accuracy and efficiency, and manage individual plants in novel ways by monitoring farms 24 hours a day, seven days a week. Because the capacity to replace human operators provides cost-effective solutions with a high return on investment, instrumental robotics applications are expanding every day to encompass new disciplines. This is especially important when the jobs that must be done pose a risk to the employees' safety or health, or when robots allow for more conservative concerns. As autonomous solutions are deployed, heavy chemical or pharmaceutical distributors, manure or fertilizer spreaders, and other activities are getting more concerned. However, the agricultural situation is deteriorating. This is because of a lack of automation. Furthermore, development requires coordination between electrical and agricultural professionals.

II. LITERATURE SURVEY

Vishnu Prakash Karunakara et al. discuss a project aimed at creating, implementing, and testing an autonomous multipurpose vehicle capable of operating in a safe, efficient, and cost-effective manner. This self-driving vehicle travels through crop lines on agricultural property, performing activities that are tiresome and/or dangerous to farmers. It was first outfitted for spraying, but alternative configurations, such as a seeding, plug platform to reach the highest portion of the plants to do various jobs (pruning, harvesting, etc.), and a trailer to transport the fruits, plants, and crop waste, have also been built.

Burra Hymavathi, J Hariharan, K Manideep, D V Srikanth, and others present an agricultural multipurpose robot project aimed at designing, implementing, and testing an autonomous multipurpose vehicle with efficiency and economic operations for tilling, sowing seeds, spraying fertilisers, and sprinkling water simultaneously. It runs on solar power, is entirely automated, and can be utilised by a single person in arid and semi-arid areas. This vehicle goes through the crop lines and completes tasks, decreasing the need for personal intervention.

Chetan Patil, Vishal Deshmukh, Shailesh Deshmukh, Govind Rai, Parag Bute, and others: create a robot capable of autonomous ploughing, seed distributing, and pesticide

spraying. It also offers manual control as needed and monitors humidity levels using humidity sensors. The essential component in this case is the microcontroller, which oversees the entire operation. Initially, the robot tills the entire area before ploughing and dispensing seeds side by side.

S N Gowtham, Anand G Warrier, Chirag B Shetty, and Gerard Elston Shawn D'souza and colleagues: present on the many agricultural chores performed by a single robot. We must find new techniques to improve the efficiency of agricultural tasks. This project is concerned with a revolutionary method of cultivating land in a highly effective manner. This agriculture robot system is notable for its multitasking capabilities, which include drilling, picking and placing, sowing, pumping water and fertilisers, and weather monitoring to work in both agriculture, afforestation, and gardening platforms. The goal of this project is to design, develop, and build a robot that can dig soil, plant seeds, close mud, and spray water. The entire robot system is powered by a battery and solar panels. More than 40% of the world's population selects agriculture as their primary vocation, and in recent years, interest in the development of autonomous cars in agriculture has grown.

Gaurav Lohakar, Jiwan Ujwalkar, Subhash Chikankar, and Rupeshkumar are among the cast members.D. Suryawanshi and colleagues:Agriculture in developed countries must discover innovative ways to boost efficiency. One strategy is to use available information technologies in the form of smarter machines to decrease and target energy inputs more effectively than in the past. Precision farming has demonstrated the benefits of this strategy, but we may now transition to a new generation of equipment. The introduction of autonomous system architectures allows us to create a completely new line of agricultural equipment based on small smart machines that can perform the right thing, in the right place, at the right time, and in the right way.

Arunkumar S M, Erik Sentury, A Harish Kumar, Johnson A, Yuvaraju G, and colleagues:Seed selection, field preparation, fertilising, sowing, irrigation, weed control, and pesticide spraying are all processes in the cultivation of any crop. Farmers must use a variety of agricultural equipment and labours to complete these steps; our goal is to combine all of the individual tools to provide farmers with multipurpose equipment that implements all of the scientific farming techniques and specifications and is suitable for all types of seed-to-seed cultivation at the lowest possible cost. This project focuses on the design and manufacture of a multipurpose agriculture vehicle that will be used for soil preparation, sowing, fertilising, levelling, and weed eradication.

➢ *Components Used:*

- *Raspberry pi.*
- *Arduino UNO mini.*
- *Battery.*
- *Relays.*
- *12V, 3A Water Pump.*
- *Solar Panel.*
- *12V Gear DC Motors.*
- *Regulated Power Supply.*
- *Bluetooth module.*
- *Moisture sensor.*

➢ *Use of Components:*

- *Raspberry Pi:*

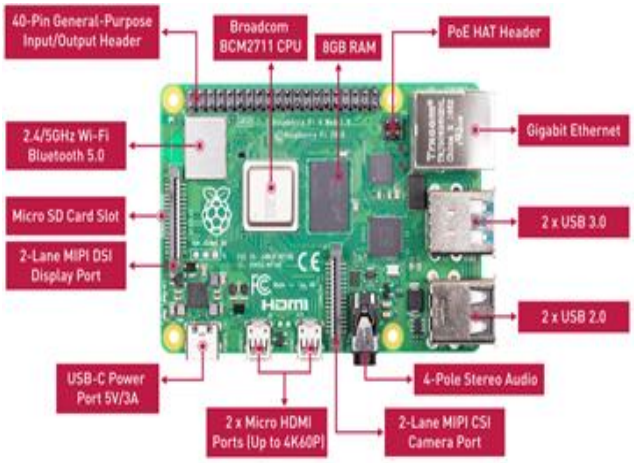

Fig 1 Raspberry Pi

The Raspberry Pi 4 Model B is the newest computer in the well-known Raspberry Pi line. It is better than the Raspberry Pi 3 Model B+ in terms of CPU speed, video performance, memory, and connections. However, it is still compatible with the Raspberry Pi 3 Model B+ and uses the same amount of power. End users can get desktop speed from the Raspberry Pi 4 Model B that is similar to that of entry-level x86 PC systems. A high-performance 64-bit quad-core processor, dual-display support at resolutions up to 4K through a pair of micro-HDMI ports, hardware video decoding at up to 4Kp60, 8GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and PoE capability (through compliance certification, which allows the board to be built into end products with a separate PoE HAT add-on). Dual-band wireless LAN and Bluetooth have flexible compliance testing, which cuts costs and time to market.

• Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz, 8GB LPDDR4 SDRAM, IEEE 802.11b/g/n/ac wireless LAN, Bluetooth 5.0, BLE • Gigabit Ethernet (true)

• 2x USB 3.0 ports, 2x USB 2.0 ports • 40-pin GPIO header that is fully backwards compatible • 2x Micro HDMI ports that support up to 4K 60Hz video resolution • 2-lane MIPI DSI/CSI ports for camera and display • 4-pole stereo audio and composite video port • MicroSD card slot for operating system and data storage.

✓ Requires 5.1V, 3A power via USB-C or GPIO
✓ PoE (Power over Ethernet) enabled (requires PoE HAT)

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- *Arduino UNO MNI:*

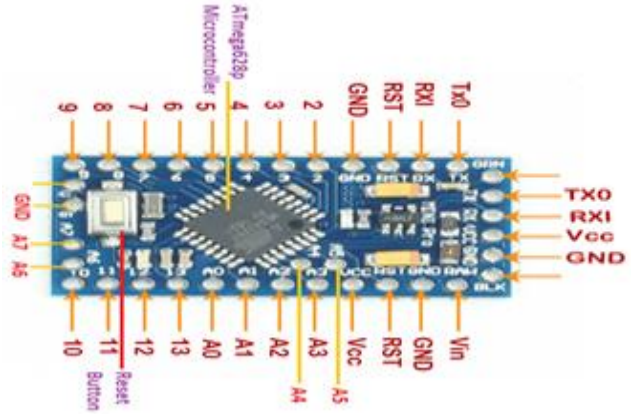

Fig 2 Arduino Pro Mini

The Arduino Pro Mini is a small Arduino board that is powered by an ATmega328P or microcontroller. The connectivity and functionality are identical to those of other Arduino boards. Advanced users love it because of its higher flexibility and tiny size. The board is available in several variations. To use the 3.3V working voltage, we must use the Arduino Pro Mini 3.3V board. We must utilise the Arduino Pro Mini 5V board for 5V. Because of its modest size, it is usually employed in small-scale projects.

The Arduino Pro Mini is organised using the Arduino IDE,, which is platform-independent. IDE is an abbreviation for Integrated Development Environment.

Arduino Pro Mini Technical Specifications. The crystal oscillator in the Arduino Nano operates at a frequency of 8MHz.Itonly has one 3.3V regulator.

It has an integrated LED. Only when we run the programme will the LED blink.

There are eight analogue pins.

There are 14 digital I/O pins, six of which are PWM (pulse width modulation) ones.

The input voltage ranges from 5 to 12 volts.

- *Solar Pannel:*

Fig 3 Solar Pannel

The sun is the source of solar energy. Solar panels (also known as "PV panels") are used to convert sunlight's light, which is made up of energy particles known as "photons," into electricity that may be used to power electrical loads. Solar panels have a wide range of applications, including remote power systems for cabins, telecommunications equipment, remote sensing, and, of course, electricity generation by residential and commercial solar electric systems.

Table 1 Specifications

Type	**Poly**
Dimensions	13.8" x 11.8" x 0.98"
Watts (STC)	10 W
Max Power Voltage (VMPP)	17.3 V
Max Power Current (IMPP)	0.59 A
Open Circuit Voltage (VOC)	21.8 V
Short Circuit Current (ISC)	0.64 A

- *Battery:*

Fig 4 Battery

- ✓ *12v 7.6ah Sealed Maintenance Free.*
- ✓ *Rated voltage 12V*
- ✓ *Capacity 7.6Ah*
- ✓ *Technology AGM*
- ✓ *Rechargeable batteries features maintenance-free*
- ✓ *Body dimensions 5.94 x 2.56 x 3.7 inches*
- ✓ *Storage time 6-9 years*
- ✓ *Weight 2.54kg*
- ✓ *Rechargeable batteries application alarm systems*
- ✓ *Power backup systems.*

- *8 Channel Relay:*

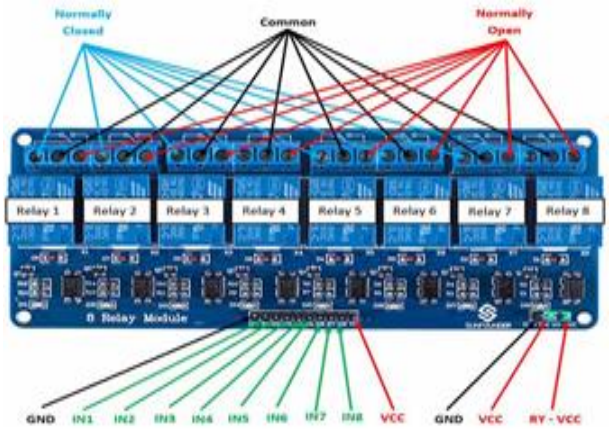

Fig 5 8 Channel Relay

By connecting a switch to an MCU, you can use a low voltage to control high voltages. The eight-channel relay module has eight 5V relays and the switching and separating parts that go with them. This makes it easy to connect the module to a microcontroller or sensor with only a few parts and connections. Each switch on the board has the same circuit, and all eight channels share the same input ground.

✓ *Details about an 8-Channel Relay Module*

• Supply voltage: 3.75V to 6V; trigger current: 5 mA; current when the relay is on: 70 mA (single) or 600 mA (all eight); relay maximum contact voltage: 250 VAC or 30 VDC; relay maximum current: 10 A.

- *Bluetooth Module:*

Fig 6 HC-05 Bluetooth Module

The HC-05 Bluetooth Module is the most popular way to set up Wireless Serial Communication because it is cheap and has a lot of great features. This module can be used either in Master mode or Slave mode, and switching between the two is easy. By default, slave mode is set up. Changes to modes can be made with AT commands. In slave mode, the HC-05 can't join to another Bluetooth device, but it can take connections from other devices. You can connect to other devices when you are in Master mode.

✓ *Specifications for the HC-05:*

- Bluetooth serial port Profile
- Bluetooth protocol: Bluetooth v2.0+EDR
- Frequency: 2.4GHz in the ISM band.
- GFSK (Gaussian Frequency Shift Keying) modulation • 4dBm Class 2 emission power • -84dBm sensitivity at 0.1% BER
- Asynchronous speed: 2.1Mbps (Max) / 160 kbps, Synchronous speed: 1Mbps/1Mbps
- Security: authentication and encryption • Power supply: +3.3VDC 50mA • Operating temperature: -20 to +75 degrees Celsius

(front, back, left, and right), two (2) high-speed motors for grass cutting and pesticide spraying, and two (2) low-torque motors for ploughing and seed sowing. All of these operations are managed by the user using Bluetooth instructions that are provided for each operation.

- *12V Gear DC Motor:*

Fig 7 Dc Motor

12V DC 10RPM Johnson geared motors with high torque for robotics applications. It has a huge torque of 120Kgcm. The motor includes a metal gearbox and an off-center shaft.

✓ *Features:*

• 12V DC motors 4500 RPM without gear box & with Gearbox 10RPM • Same size motor available in varied rpm • 6mm Dia shaft with M3 thread hole • Gearbox diameter 37 mm.• Motor Diameter: 28.5 mm • Length: 63 mm without shaft • Shaft length: 30mm • Weight: 180gm • Rated Torque: 472.6 N-cm • No-load current: 60 mA (Max), Load current: 300 mA (Max)

- *Water Pump:*

Fig 8 Water Pump

Table 2 Motor Specification

Brand	Earth Max
Model Number	EM-4949
Voltage	12 V Nom.(9-14.4V)
Current	3.4 A
Flow	6 LPM
Pressure	135 PSI (9 Bar)
Minimum Order Quantity	40 Unit

➢ *Working:*

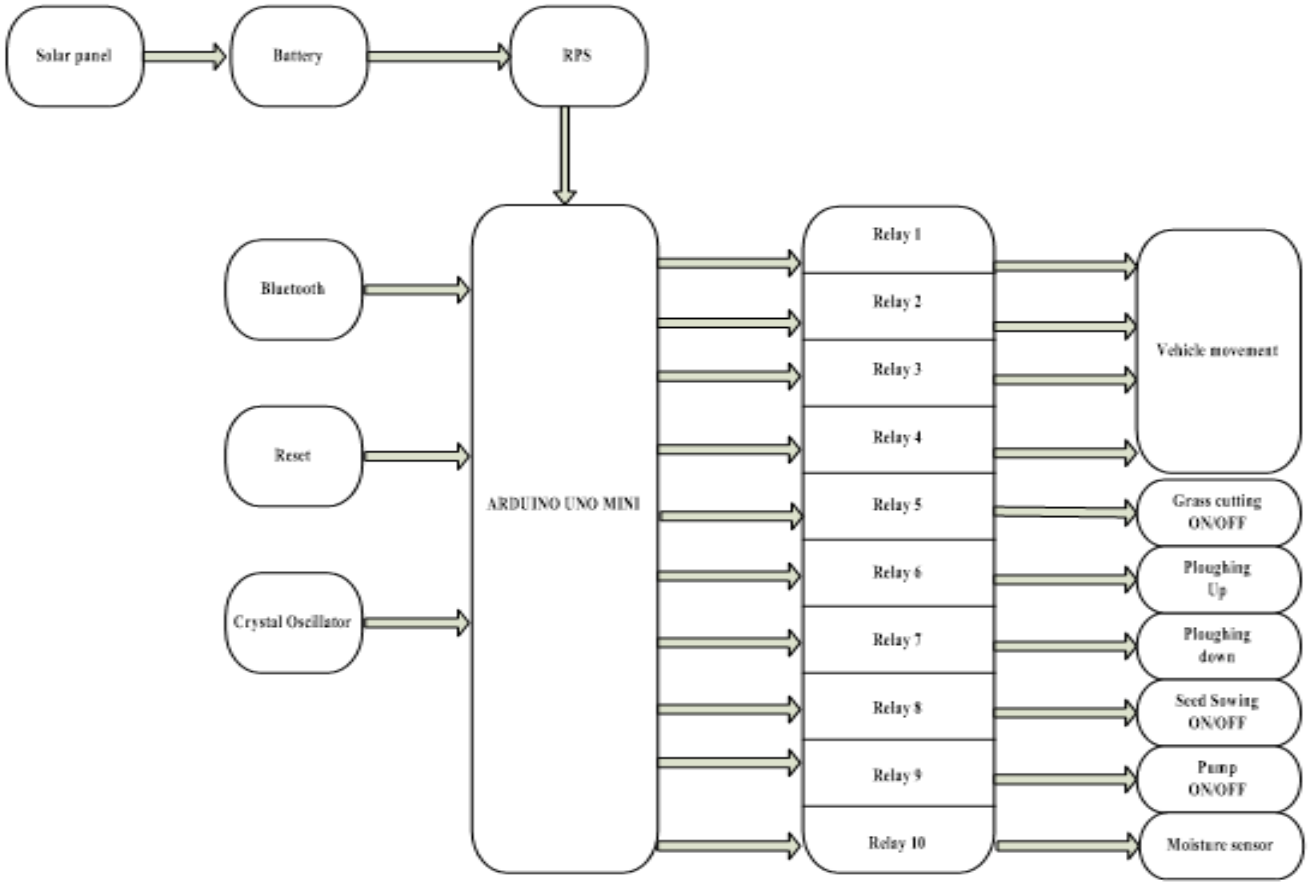

Fig 9 Block Diagram of Agriculture Robot

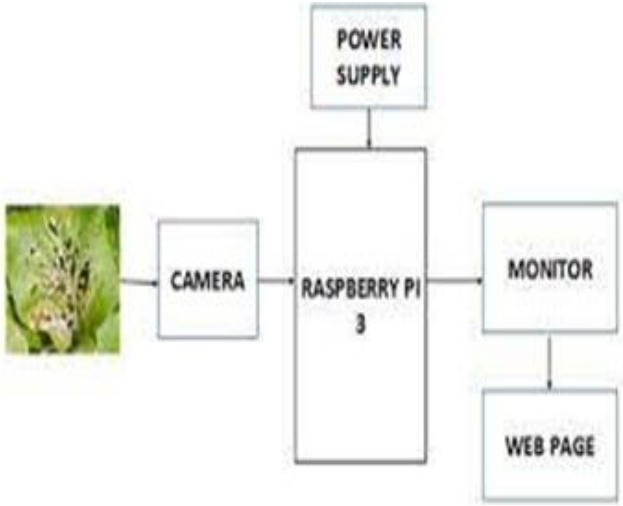

Fig 10 Block Diagram of Raspberrypi Leaf Disease Detection

The robot is designed to assist and simplify daily farming activities. It combines many processes such as grass cutting, ploughing, seed planting, pesticide spraying, moisture measurement in soil, and leaf disease detection using dc motors, pumps, sprayers, an Arduino Uno, a Bluetooth module, and a Raspberry Pi.

A Bluetooth module controls the robot. The operator must download the Bluetooth Terminal HC-05 application from the Google Play store. This app is used to control the robot or transmit commands to it. The robot is equipped with a Bluetooth module (HC-05) that can receive commands from up to 20 metres away from the operator and send them to the Arduino Uno Mini via the receiver port. To perform the required operation, the various relays are connected to the various components of the robot. These relays receive input commands from the Arduino Uno Mini based on the user's requirements, with the various Arduino

Uno pins attached to the various relays. The robot relies on a battery, which is constantly charged by a solar panel as it is depleted by the motors and other circuits. When the solar panel is exposed to sunlight, it extends the battery's life.

The robot is outfitted with eight (8) dc motors, including four (4) high-torque motors for four-wheel movement (front, back, left, and right), two (2) high-speed motors for grass cutting and pesticide spraying, and two (2) low-torque motors for ploughing and seed sowing. All of these operations are managed by the user using Bluetooth instructions that are provided for each operation.

➢ *Modeling and Analysis:*

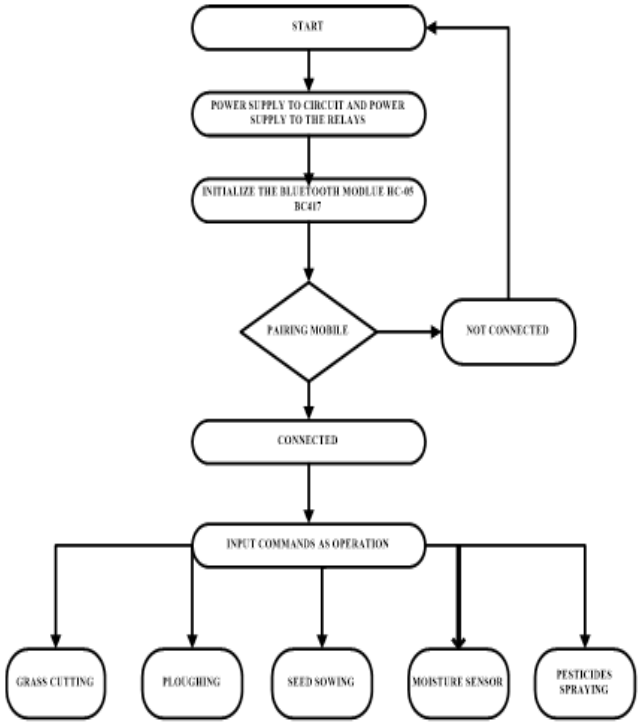

Fig 11 Modeling and Analysis

III. RESULT

This article depicts the multi-functions of the device. By using this device all agriculture needs can fulfil this device can give seed sowing gross cutting, ploughing and pumping from the figures 7.1 to 7.8 depicts working models.

Fig 12 Grass Cutter

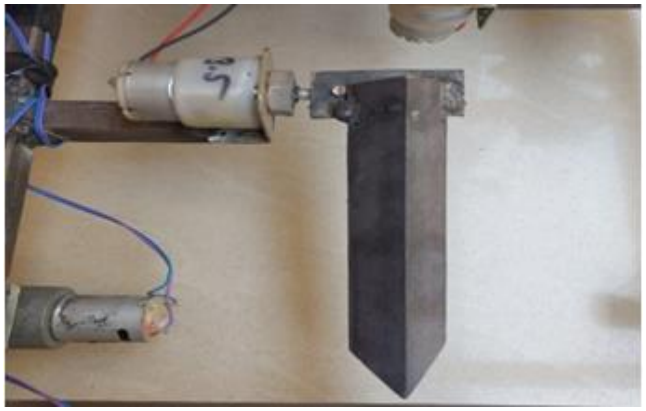

Fig 13 Grass Cutter

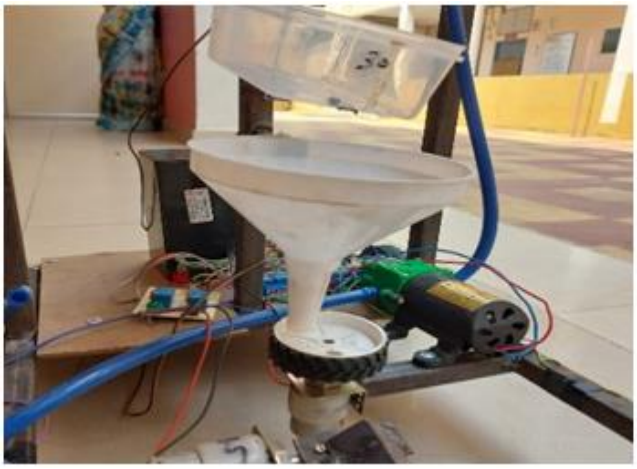

Fig 14 Seed Sowing

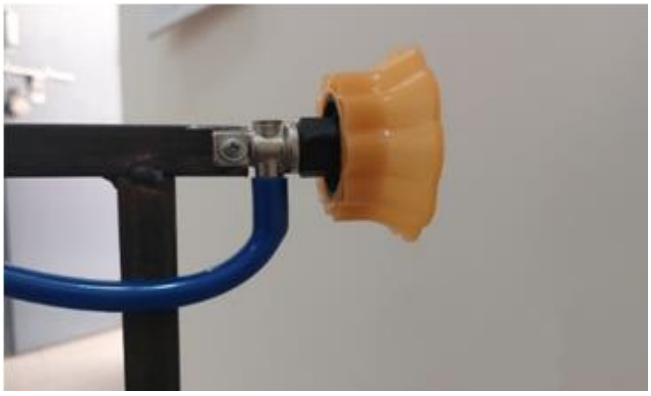

Fig 15 Pestiside Sprayer

Fig 16 Water Pupm

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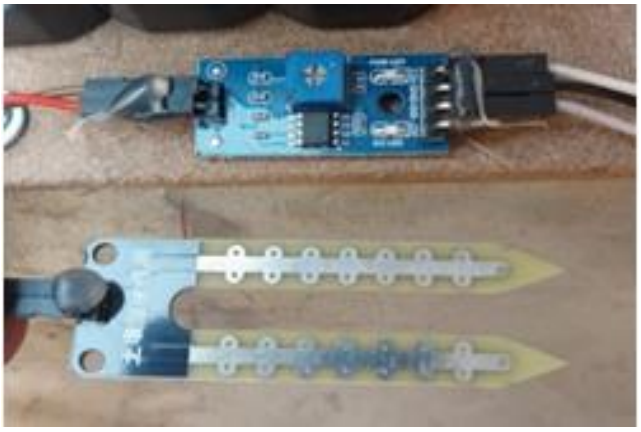

Fig 17 Moisture Sensor

Fig 18 Raspberry Pi

Fig 19 Complete Model

IV. CONCLUSION

This study will help improve farming tasks that can be used for more than one thing, such as cutting grass, ploughing, sowing seeds, spraying pesticides, and finding leaf diseases. A Bluetooth gadget on a phone or tablet controls this robot. This planned work serves more than one purpose. It cuts down on staff costs, saves time, and makes sure that production goes smoothly. In the Bluetooth control module, which is part of the robot, Bluetooth is used. The raspberry pi can do different things, like change the way and cut the grass, plough, plant seeds, spray pesticides, and look for leaf diseases.

REFERENCES

[1]. Simon Blackmore, Bill Stout, Maohua Wang,BorisRunov (2005), Robotic agriculture – The future ofagriculture mechanism, Agro Technology, the royal veterinary and agriculture University.

[2]. Agricultural Census: All India report on number andarea of operational holdings. Agricultural censusdivision, Department of agriculture and co-operation,Ministry of Agriculture, Government of India 2014.

[3]. R. Eaton, R. Eaton, J. Katupitiya, S.D. Pathirana(2008), Autonomous farming: Modeling and controlof agricultural machinery in a unifiedframework,15th international conference on mechatronicsand machine vision in practice,NewZealand.

[4]. Simon Blackmore, Bill Stout, MaohuaWang, BorisRunov (2005), “A systems view of agriculturalrobotics”, Agro Technology, the royal veterinary andagriculture University.

[5]. R. Eaton, R. Eaton, J. Katupitiya, S D Pathirana(2008), “Autonomous farming: Modeling andcontrol of agricultural machinery in a unifiedframework

[6]. Akhila Gollakota, "A Multipurpose AgriculturalRobot ", Birla Institute of Technology and Science,Hyderabad Campus

[7]. Vishnu Prakash K, Sathish Kumar V, Venkatesh P,Chandran A (2016), “DESIGN AND FABRICATIONOF MULTIPURPOSE AGRICULTURAL “ROBOT”,International Journal of Advanced Science and Engineering Research,

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