AGRI ROBOT FOR MULTIPURPOSE APPLICATIONS

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ABSTRACT:

In India, farming supports over 70% of the population. In the agricultural field, many tasks are carried out, such as planting seeds, levelling mud, plugging, and so forth. The current techniques for smoothing muck, applying pesticides, and planting seeds are troublesome. The instruments required for the aforementioned motions are costly and challenging to operate. Therefore, it is important to support India's agricultural system by creating a method that would need less labour and time. The purpose of this study is to design, develop, and build a robot that can detect impediments and simultaneously plant seeds, level dirt, and spray pesticides. Solar energy powers this whole system. The robot is powered by a solar panel and is controlled by an Android or Bluetooth app that provides signals to the robot for the necessary mechanics and movement. This lessens the issues encountered during hand planting and improves the effectiveness of mud levelling, pesticide application, and seed sowing. The robot employs an Android app as a remote controller for labour-intensive control.

I. INTRODUCTION

The majority of economies are based on agriculture, and technical developments in this sector are essential to raising sustainability, productivity, and efficiency. An inventive solar-powered solution called the Agri Robot for Multipurpose Applications was created to tackle important agricultural issues. With ease and accuracy, this robot can carry out a variety of agricultural chores including levelling soil, planting seeds, and applying pesticides.

The robot gives farmers the opportunity to remotely monitor and control activities since it is equipped with Bluetooth and Android TCPTel app-based control. The robot provides economical and environmentally friendly performance by using solar energy, which lessens dependency on conventional fuel sources.

This cutting-edge technology is a vital tool for the agriculture of the future since it offers a clever, automated approach to farming that aims to decrease human labour, enhance crop output, and encourage sustainable farming methods.

Modern technology is quickly changing agricultural operations, and one ground-breaking development in this area is the Agri Robot for Multipurpose Applications. This robot is a flexible solution that reduces labour-intensive operations and increases output by doing basic agricultural activities on its own.

The Agri Robot is designed to perform a number of vital tasks:

1. **Seed Sowing:** The robot eliminates the need for human labour by accurately planting seeds at consistent depths and intervals, guaranteeing maximum crop development.
2. **Soil Levelling:** It effectively levels the soil, giving an equal surface for improved crop emergence and water distribution.
3. **Pesticide Spraying:** With its automated spraying systems, the robot precisely sprays pesticides on crops, reducing waste and its negative effects on the environment while preserving crop health.

Via an Android TCPTel app, customers may remotely control the robot thanks to its Bluetooth-enabled control system. Farmers can manage their fields with more freedom and

accuracy thanks to the wireless control's real-time monitoring and adjusting capabilities.

This robot's primary characteristic is its dependency on solar power, which makes it an energy- and environmentally-efficient device. The Agri Robot uses less fuel and spends less money on operations by using solar energy, which promotes more environmentally friendly agricultural methods.

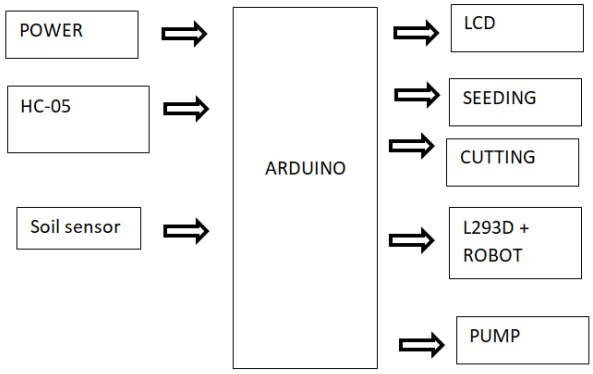
The incorporation of this versatile Agri Robot into contemporary farming systems enhances the efficiency, environmental consciousness, and scalability of agricultural operations. This creative approach is a great resource for farming in the future as it addresses labour shortages, improves overall farm management, and increases produce consistency.

II. LITERATURE SURVEY

Robotics usage in agriculture increases production while lowering costs and human labour. It is envisaged that several agricultural tasks would be automated by robots. According to descriptions, the current robot performs better and can automate many tasks at once. Farmers may employ this robot with efficiency. Future upgrades might give this robot the ability to think more clearly and to behave appropriately even when the farmers are not there. According to Blackmore, S. (2007), it may be brought about via human connection as well as learning from experience. "A robotics system's perspective on agriculture"[4]. The notion that the PFDS and PADS should be implemented, together with their strong interplay, was central to this concept. According to R. Eaton, R. Eaton, J. Katupitiya, and S. D. Pathirana (2008), "Autonomous farming: Modelling and control of agricultural machinery in a unified framework," the PADS are used to communicate the agronomy information about, and requirements of, the crop, while the PFDS are primarily used to relay spatial accuracy information for machinery navigation [5].

III. BLOCK DIAGRAM AND HARDWARE DISCRIPTION

3.1. BLOCK DIAGRAM:



POWER SUPPLY

Every digital circuit needs a power source that is controlled. We will discover how to get a controlled positive supply from the main supply in this post.

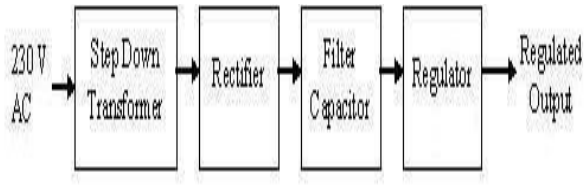


Figure 1 Displays the fundamental schematic of a stationary regulated power supply.

Let us go through each block.

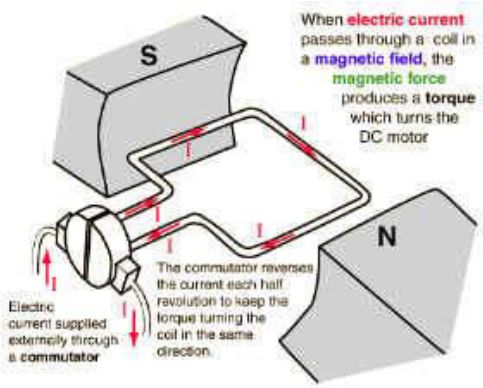
L293D:

Half-H drivers with triple high-current include the L293 and L293D. With voltages ranging from 4.5 V to 36 V, the L293 is intended to provide bidirectional driving currents of up to 1 A. Up to 600 mA of bidirectional driving current may be achieved with the L293D at voltages ranging from 4.5 V to 36 V. In positive-supply applications, these devices are intended to drive inductive loads such solenoids, relays, dc, and bipolar stepping motors, in addition to other high-current/high-voltage loads. Every input is compatible with TTL. With a pseudo-Darlington source and a Darlington transistor sink, each output is a full

totem-pole driving circuit. Drivers 1 and 2 are enabled by 1,2EN, while drivers 3 and 4 are enabled by 3,4EN. Drivers are enabled in pairs. The corresponding drivers are activated and their outputs are active and in phase with their inputs when an enable input is high. These drivers are disabled and their outputs are turned off and in the high-impedance condition when the enable input is low. Each pair of drivers creates a full-H (or bridge) reversible drive appropriate for solenoid or motor applications when the right data inputs are provided.

DC MOTOR

A DC motor is intended to operate with DC electricity. Michael Faraday's homopolar motor, which is rare, and the ball bearin motor, which is a recent invention, are two instances of pure DC designs. The two most popular forms of DC motors are brushed and brushless, which are not strictly speaking DC machines since they require internal and external commutation, respectively, to produce an oscillating AC current from the DC source.



Bluetooth

Bluetooth is a wireless protocol that creates wireless personal area networks (PANs) by enabling data transfer from stationary and/or mobile devices over small distances using short-range communications technology. The idea behind Bluetooth's development was to create a single digital wireless protocol that could link many devices and solve problems caused by device synchronisation. Bluetooth makes advantage of frequency hopping spread spectrum, an extremely powerful radio technology. The data is broken up and delivered in segments across a maximum of 75 frequencies. Gaussian frequency shift keying (GFSK) modulation is used in its most basic form. A gross data rate of 1 Mb/s may be attained using it. Using a safe, internationally unlicensed Industrial, Scientific, and Medical (ISM) 2.4 GHz short-range radio frequency bandwidth, Bluetooth enables communication and connection between gadgets like mobile phones, landlines, laptops, desktop computers, printers, GPS receivers, digital cameras, and video game consoles. The Bluetooth Special Interest Group (SIG) is responsible for developing and licensing the Bluetooth standards. Businesses in the fields of consumer electronics, networking, computers, and telephony make up the Bluetooth SIG.

Based on inexpensive transceiver microchips found in each device, Bluetooth is a standard and communications protocol with a limited range (power-class-dependent: 1 meter, 10 meters, 100 meters). Its main goal is low power consumption. When these gadgets are within range of one another, Bluetooth allows them to communicate. The Bluetooth device class indicates the type of device and the supported services of which the information is transmitted during the discovery process. In order to use the radio communications system, the devices do not need to be in line of sight of each other and can even be in different rooms, provided that the received transmission is strong enough.

Soil Moisture Sensor:

Both plant gardens and irrigation fields depend heavily on the soil's moisture content. As nutrients in the soil provide plants the nourishment they need to flourish. It is also necessary to water the plants in order to alter their temperature. Through a process similar to transpiration, water may be used to alter the plant's temperature. Also, plants that grow in damp soil have better-developed root systems. Severe soil moisture levels may lead to anaerobic conditions that can promote the development of soil pathogens and plants. An overview of the soil moisture sensor's operation and applications is included in this article.

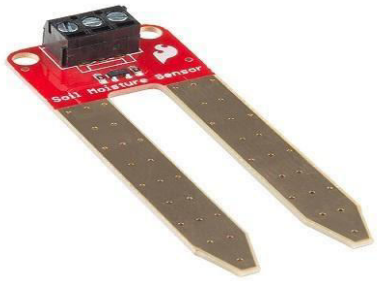


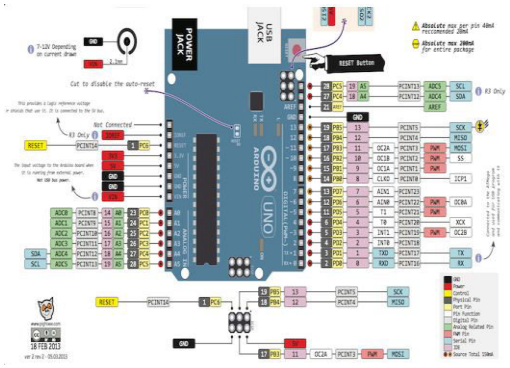
Fig: soil-moisture-sensor-device

These sensors are often employed to measure the volumetric water content, while a another set of sensors determines the water potential—a newly defined feature of moisture in soils. Usually referred to as soil water potential sensors, these devices include tensiometers and gypsum blocks.

Arduino

Using microcontroller kits, Arduino is a computer hardware and software corporation, project, and user community that creates interactive things and digital devices that can detect and control real-world items. The GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL)[1] govern the dissemination of the project's open-source hardware and software, allowing anyone to produce Arduino boards and distribute software. Commercial preassembled Arduino boards are available, as well as DIY kits.

An assortment of microprocessors and controllers are used in Arduino board designs. Sets of digital and analogue input/output (I/O) pins on the boards allow them to be interfaced with different expansion boards (shields) and other circuits. The boards include serial communications interfaces, some of which support USB (Universal Serial Bus), which is also used to load software from personal computers. A variant of the C and C++ programming languages is usually used to program the microcontrollers. The Arduino project offers an integrated development environment (IDE) based on the Processing language project in addition to utilising conventional compiler toolchains.



Project Working

The Agri Robot is fuelled by solar energy and can be operated by Bluetooth or an Android TCPTel app. It is designed to automate basic agricultural operations including levelling soil, spraying pesticide, and planting seeds. In order to do these tasks effectively, a mix of mechanical, electrical, and software systems work together.

1. Power Supply: Solar-Powered Operation

- The robot has solar panels installed, which use the sun's energy to recharge its internal battery. This guarantees the robot's environmental friendliness and its ability to function in the field without external power sources.
- As long as there is a stored charge, the battery powers the robot's motors, sensors, and control systems, allowing for uninterrupted operation even on overcast days or at night.

2. Control System: Bluetooth & Android App

- Using the TCPTel software, farmers can wirelessly link their Android smartphone to the robot's Bluetooth module and use it to control and monitor the robot's actions in real time.
- Initiating tasks (like seed sowing, levelling, or spraying) and modifying parameters (like speed, seed placement depth, or pesticide spray intensity) are all included in this.
- The app offers an intuitive remote control interface that enables farmers to operate the robot remotely, adding convenience and versatility.

3. Seed Sowing Mechanism

- A seed hopper and a seed dispenser mechanism that regulates the discharge of seeds into the soil are features of the robot.
- While the distance control mechanism provides consistent seed spacing, the depth control sensors guarantee that the seeds are planted at a uniform depth.
- In the field, the robot follows pre-programmed tracks to precisely plant seeds, minimise waste, and provide ideal circumstances for plant development.

4. Soil Leveling Mechanism

- The robot levels the soil as it travels over the field by using a revolving blade or levelling tool that is attached to the front or bottom.
- This guarantees level ground, which is essential for effective irrigation and plant development. Additionally, a level field aids in avoiding waterlogging and inadequate drainage.
- To keep a constant soil level, the robot employs sensors to identify the terrain and automatically modifies the levelling tool.

5. Pesticide Spraying Mechanism

- The robot can evenly and effectively spray pesticides over fields since it has a pesticide tank and a spraying mechanism.
- The app, which controls the spraying mechanism, is linked to nozzles and has the ability to set the spraying range and flow rate.
- By detecting crop rows and adjusting the spraying system to prevent overspraying or underspraying, the robot's sensors and cameras can minimise pesticide waste and lessen environmental impact.

6. Sensors and Navigation

- The robot can identify and manoeuvre around obstacles thanks to a variety of sensors, including infrared, proximity, and ultrasonic ones. This guarantees efficient functioning without causing harm to crops or becoming trapped.
- By using waypoints controlled by an app or pre-programmed GPS coordinates, the robot travels over the field precisely, covering all the places it needs to do jobs.
- When levelling soil or sowing seeds on uneven terrain, terrain detecting sensors also assist in keeping the robot balanced.

7. Automation and Efficiency

- fter being launched, the robot moves on its own accordance with input orders.

Via the app, the farmer may keep an eye on its development and take appropriate action.

- Compared to manual activities, automation lowers labour costs and guarantees more precise and consistent output.

IV. CONCLUSION

The multifunctional agricultural robot is an effective vehicle because it provides an advanced technique of sowing, plough, and cutting crops with the least amount of labour and manpower. Depending on the crop, the machine will cultivate the farm by taking into account specified rows and columns at predetermined distances. Robots have the potential to increase human quality of life and provide prospects for future humankind to develop an improved model for the benefit of farmers. Robots have enormous potential for enhancing production in agriculture, and more and more of them are showing up on farms in different forms. Probably with the help of technology, the remaining issues related to autonomous agricultural equipment can be resolved.These devices could be there in the future, but there are good grounds to believe that they might include more than simply computer drivers taking the place of human drivers. It can entail reconsidering the methods used in agricultural production. A swarm of little machines may produce crops more efficiently and economically than a few giant ones. The fact that the non-farm population may find the smaller machines more palatable is one of their benefits. Agriculture occupations are tedious, risky, and need rapid thinking in addition to a great deal of repetition; for these reasons, human operators may be properly replaced by robots. In comparison to conventional ways, the machine uses less labour and less time; thus, if we build it in large quantities, its cost will be much reduced, and we think that this will partially meet the needs of Indian agriculture. Thus, we may address the labour shortage that modern Indian farming requires in this manner.

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