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MULTI PURPOSE AGRICULTURE ELECTRIC TRACTOR

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ABSTRACT: The cultivation, production, and selling of crops, animals, and agricultural goods. Farmers face challenges in agriculture, including ploughing, seed planting, and watering, which involve significant expenditure and effort. To simplify these procedures, this project was created. This project involves an Android-controlled farm robot. It has 2 phases. Bluetooth orders from an Android phone control the stage-I's DC motors for plowing, seed sowing, and leveling. The Arduino microprocessor controls motors using H-bridges and relays. A rechargeable battery powers the device, proving its potential for large-scale agriculture. Stage II automates seed planting using an Android-controlled equipment. Our equipment levels, removes weeds, and sprays pesticides. The seed container vibrates, and 7 DC motors with reduction gear systems regulate plowing and forward movement.

Its Bluetooth remote control makes this versatile agricultural robot convenient. A Bluetooth-controlled agricultural robot with automated functionality shows how Android smartphone control may be used for large-scale agriculture. A high-tech automated seed sower reduces manual labor in the second part, modernizing agricultural procedures.

INTRODUCTION

The growth or development of any nation in the world is purely depends up on the agriculture production. If proper machinery is used in this field, accuracy in the forming and quality in the production can be achieved. Traditional methods of sowing seeds manually and other activities like ploughing, water pouring, pesticide spraying, etc are done manually that consume lot of time and also it may not be accurate because of human errors. The machine designed here is quite useful for the large cultivated areas. A 4-in- one machine that automates seed planting, ploughing, water pouring, and pesticide spraying. Controlled via a remote Android device with Bluetooth connectivity, the machine reducesmanual labor, enhances accuracy, and saves time. The prototype focuseson single-row seedplanting but can be scaled for large cultivated areas, improving efficiency. The mechatronics-based system utilizes Arduino microcontroller, DC motors, and solenoid coils for precision control. The Android app facilitates seamlesscommunication, allowing the operator to remotely control the machine's movements and tasks. This innovative solution addresses the challenges faced by farmers, aligning with the global trend of adopting advanced agricultural technologies for increased productivity.

LITERATURE SURVEY

A literature survey on multi-purpose agriculture robot was conducted.

C. H. Chavan and P. V. Karande, "Wireless Monitoring of Soil Moisture Temperature & Humidity Using Zigbee in Agriculture", International Journal of Engineering Trendsand Technology (IJETT), vol. 11, May 2016.[1]

Trupti A. Shinde and Jayashree. S. Awati, "Design and Development of Automatic Seed Sowing Machine",

International Journal of Electronics and Communication Engineering - (ICRTESTM), pp. 40-44, April 2017.[2]
Nikita Chame, Mamta Jadhav, Priyanka Tele and Snehal P. Hon, "Design and Implementation of Automatic Seed Sowing Robot", International Journal of Research in Engineering Science and Management, vol. 1, pp. 102-103, May 2018.[3]
J. Rajesh, R. Dinesh, S. Gowtham and K. Iniyavan, "Autonomous Adjustable Pesticide Spraying Device for Agricultural Application", International Research Journal of Engineering and Technology, vol. 06, pp. 4572-4577, Mar 2019.[4]

VECHILE MECHANISM

SEED PLANTING MECHANISM

The seed planting mechanism is designed in a funnel mechanism with a long pipe to it. The mechanical system is considered as motion converter, this can be created by implementing electro-mechanical techniques. The concept is to transform the motion from one form to some other required form by using suitable mechanical and electrical devices. The mechanical transmission section designed over the mechanical frame carries the seed sowing container i.e., the funnel to the destination through linear motion which is created by the vehicle movement.

The seed planting mechanism designed using solenoid coil & vibrating motor is aimedto plant seeds at specific points at specified distance programmed through main processing unit. This mechanism arranged over the moving metal structure occupies after the plough mechanism, initially a small plough arranged over the chassis at front side, after that this mechanism is arranged.

Initially the movement of the mechanism is to be calculated, means depending up onthe time allowed to move the mechanism must be calculated, for example if both motorsare driven in forward direction for 2 seconds, how far the mechanism moved must benoted down. If the mechanism moves 10 centimeters, assume that that the mechanismwill plant the seeds continuously at a distance of every 10cm's. Means themovingmechanism stops at every 10cm's distance, and a seed will be planted automatically. The vibrating DC motor coupled with seed planting mechanism will remain inenergized condition until the stop button is activated in the remote control unit. This motor is connected with an un-balanced load coupled with shaft can vibrate the mechanism. The idea of using this vibrating mechanism is to draw the seeds freely froma metal tube arranged to a funnel. If this vibrator is not there, chances are there that theseeds may jam inside the pipe. To release the seeds from the funnel pipe, vibrator isessential.

The advantage of selecting reduction gear mechanism motors is that a small motorcan drive heavy loads. As these motors are purchased from local market, ratings' regarding torque is not mentioned. Only speed (RPM) and the operating voltage are specified. As per this data the motor is designed to operate at 12V DC and the motor

speed is 30/60 RPM. These motors driving capacity is tested practically and in our test we came to know that each motor can drive an independent load of maximum 3Kg.There by according to this driving capacity, one small mechanical structure of this project is designed for the demo purpose.

In order to sow the seed in the soil, first ploughing is to be done. So the vehicle is equipped with the metal blade like mechanism for ploughing which are placed just before the seed planting equipment on the vehicle. In addition one more metal plate is arranged after the seeding equipment to cover the seed with soil. For the entire

vehicle movement, the vehicle driving motors are connected through big wheels for higher grip control mechanism.

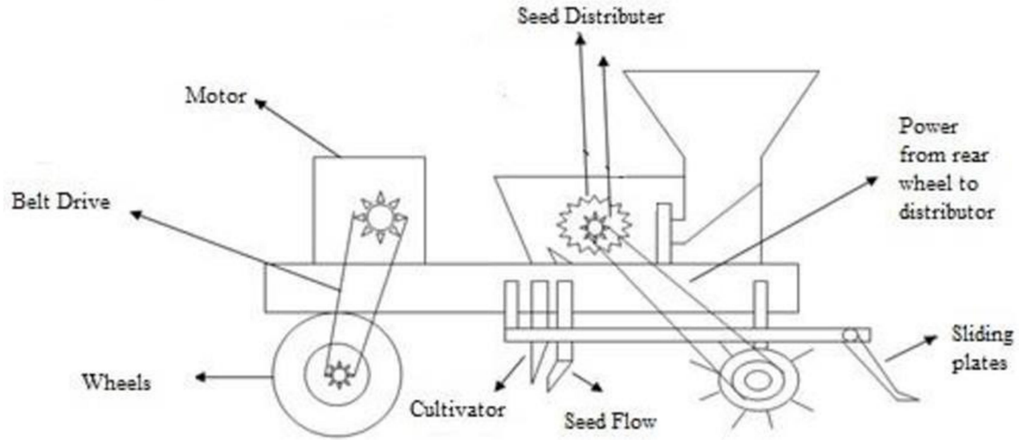

Figure 1 Seed planting Mechanism

TECHNICAL ARCHITECURE

Block Diagram

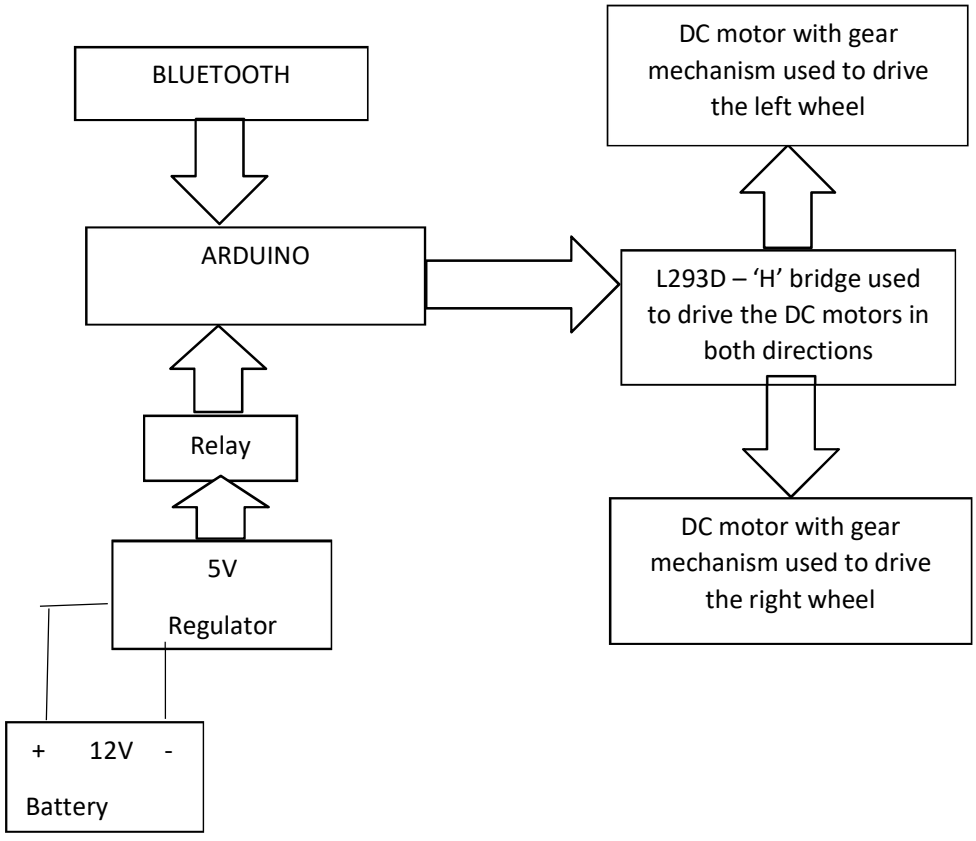

Fig: 2 Block diagram of Multipurpose Agriculture Electric Tractor

In this chapter the block diagram of the project and design aspect of independentmodules are considered. The following are the components used in the project work:

1. Arduino
2. Bluetooth Module
3. L293D H – Bridge IC's
4. Relays
5. Voltage Regulator IC (7805)

TESTING AND RESULTS

HARDWARE MODULE

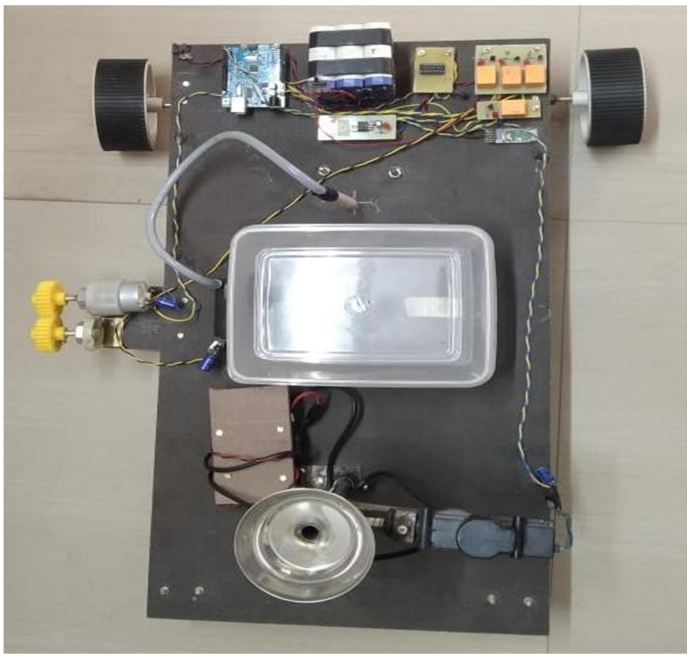

Fig. 3 Top View

The above figure shows the hardware module of the multipurpose agriculture vehicle.

Additionally, the Arduino Uno's programmability enables the implementation of algorithms for autonomous navigation within the agricultural field. Through the integration of motor controllers and actuators, the robot can perform tasks like planting seeds, applying fertilizers, or even harvesting crops. The real-time processing capabilities of the Arduino Uno contribute to the efficiency of these operations, enhancing the overall productivity of the agriculture robot.

Moreover, the Arduino Uno facilitates communication with external devices and systems,enabling the robot to be part of a larger smart farming network. This connectivity allows farmers to remotely monitor and control the robot, receive real-time updates, and analyze collected data for more informed decision-making.

In summary, the Arduino Uno acts as the brain of the multi-purpose agriculture robot, enabling it to sense, process, and act upon the agricultural environment, contributing to increased efficiency, sustainability, and

precision in modern farming practices.

Fig. 4 Back View

The plowing and soil leveling plates of the multifunctional farm truck are seen in the rear.

Ploughing—Multi-purpose farm vehicles' ploughing plates crush and turn dirt. Ploughing loosens soil, burys agricultural leftovers, and prepares a seedbed. Ploughing plates improve soil aeration and water infiltration, increasing agricultural production. A multi-purpose farm vehicle's soil leveling plates smooth and level the soil surface after plowing or other soil-disturbing operations. Their main purpose is flattening the seedbed. This improves equal seed dispersal, consistent germination, and eases agricultural activities including planting, watering, and harvesting. Soil leveling plates also improve water distribution, field unevenness, and crop performance.

TESTING AND RESULTS

VEHICLE MOVEMENTSLEFT DIRECTION

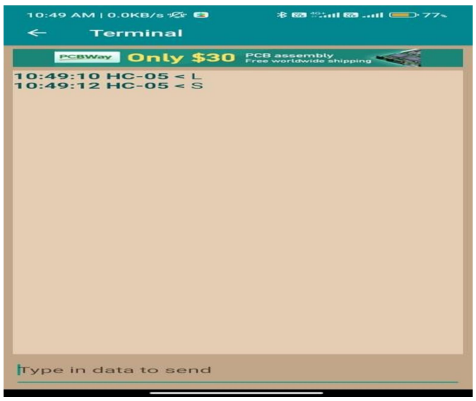

Fig 5: Command for Vehicle movement: Left

Fig 6: Vehicle movement: Left

This is the command used for the vehicle movement. The Arduino Blue Control is the app for passing these commands from the smart phone to the Bluetooth. By passing the **LEFT** direction command the vehicle moves towards the left direction.

RIGHT DIRECTION

Fig 7: Command for Vehicle movement: Right

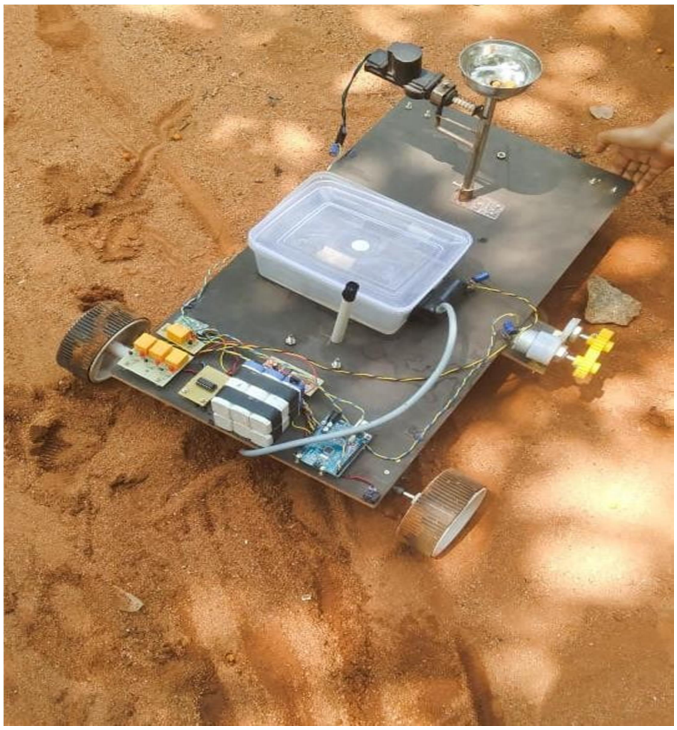

Fig 8: Vehicle movement: Right

This is the command used for the vehicle movement. The Arduino Blue Control is the app for passing these commands from the smart phone to the Bluetooth. By passing the**RIGHT** direction command the vehicle moves towards the left direction.

MULTIPLE OPERATIONS OF MULTIPURPOSE ELECTRICTRACTOR

CULTIVATING OPERATION

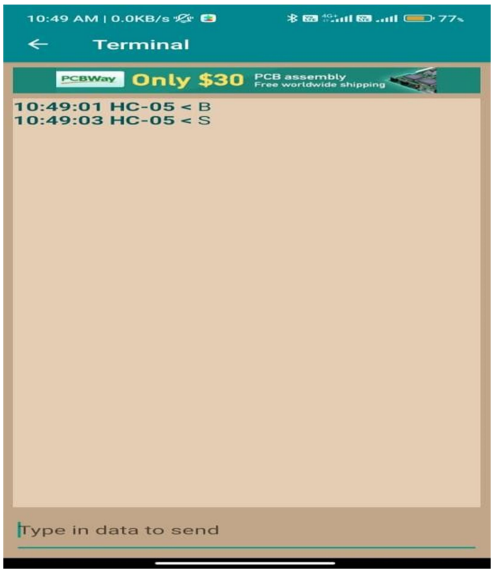

Fig 9: Command for Backward direction

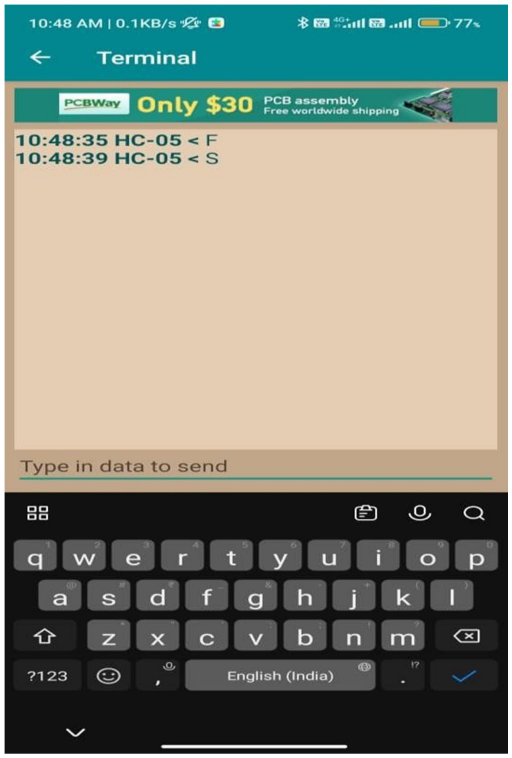

Fig 10: Command for Forward direction

Fig 11: Cultivating Operation

SEED SOWING OPERATION

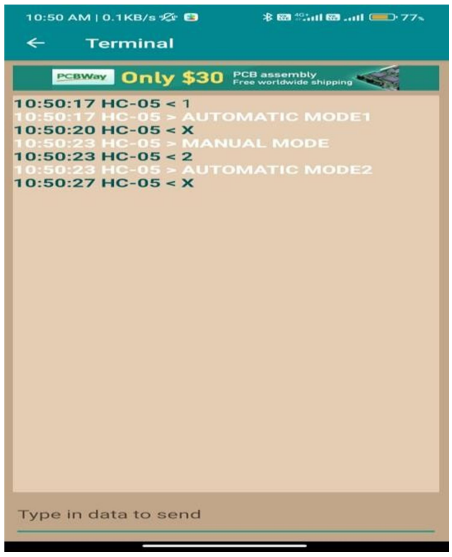

Fig 12: Commands for seed sowing operation

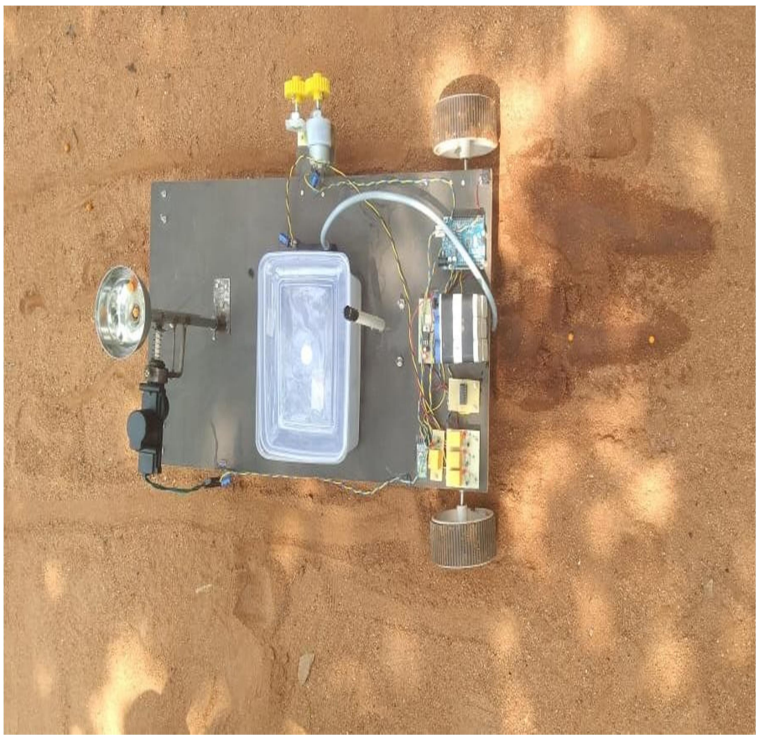

Fig 13 :Seed Sowing Operation

LEVELING OPERATION

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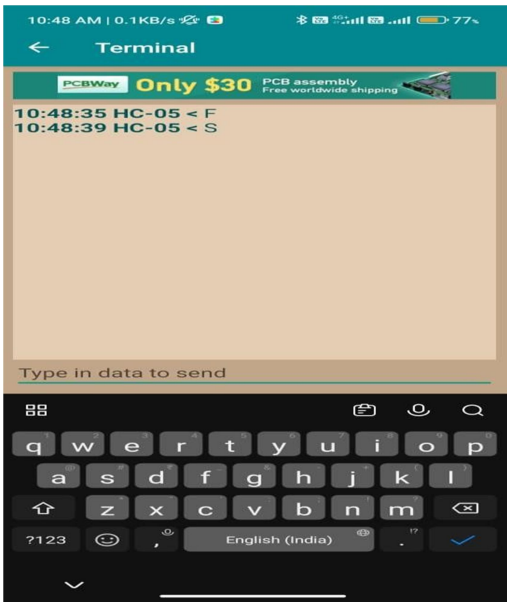

Fig 14: Command for Forward direction

Fig 15: Levelling operation

WATER PUMPING

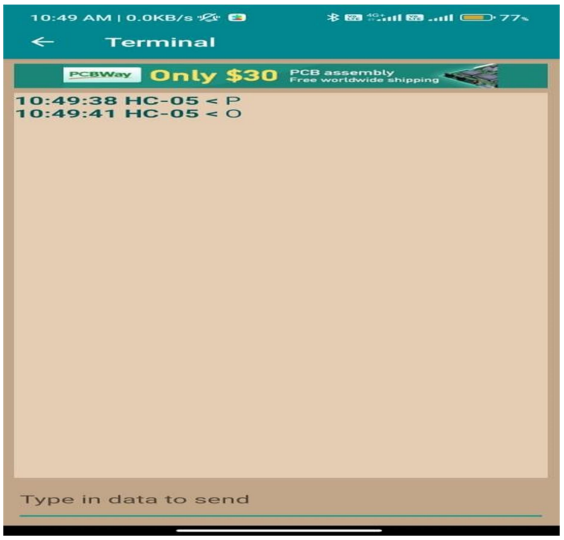

Fig 16: Command for Water Pumping

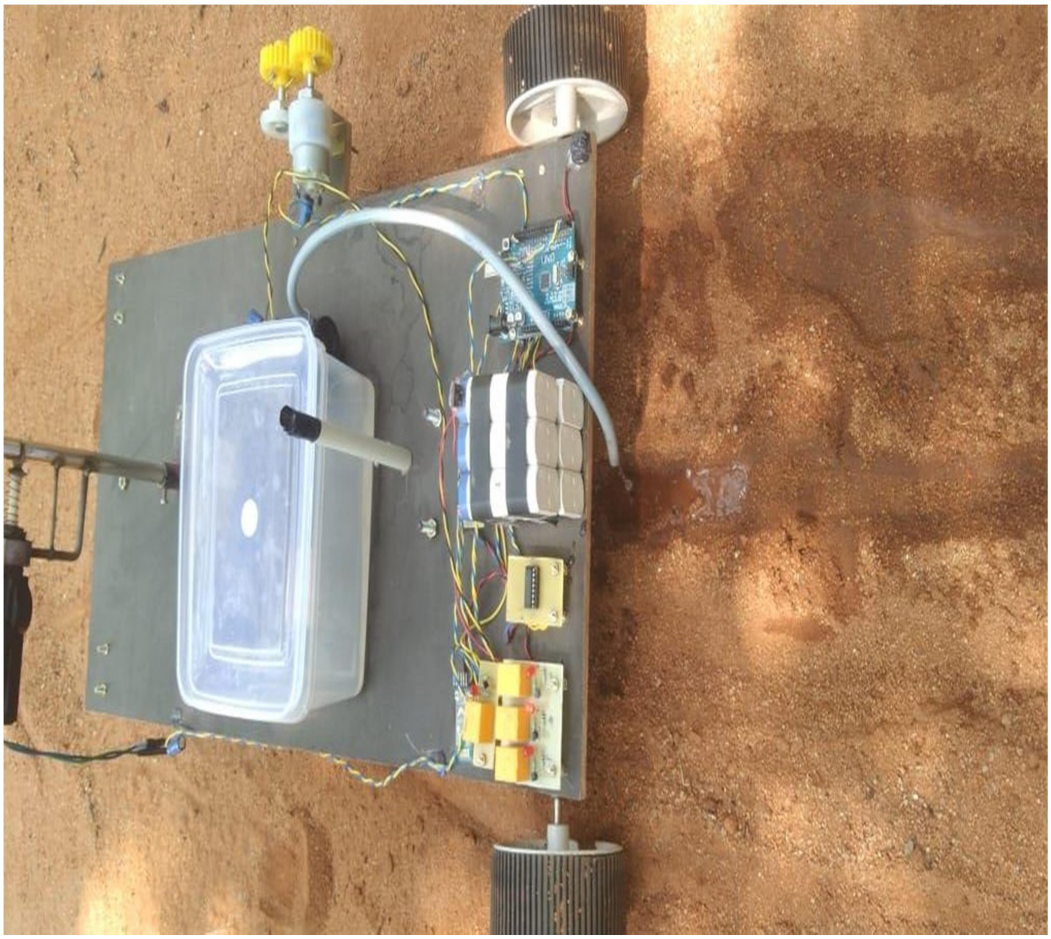

Fig 17: Water pumping Operation

WEED CUTTING

Fig 18: Command for Weed Cutting

Fig 19: Weed Cutting Operation

For a multi-purpose agriculture electric tractor, integrating a weed-cutting process involves incorporating specialized attachments or implements that can efficiently cut weeds while the tractor moves through the fields. This could include equipment like rotary mowers, flail mowers, or specialized weed cutters attached to the tractor's front, rear, or undercarriage. The electric tractor's power source would drive these implements, offering a sustainable and eco-friendly solution for weed management in agricultural fields.

TABLE1: Commands for Different Directions

S.NO	DIRECTIONS	COMMANDS
1.	FORWARD	F
2.	BACKWARD	B
3.	RIGHT	R
4.	LEFT	L
5.	STOP	S
6.	WATER PUMPING	P
7.	WATER PUMPING STOP	O
8.	WEED CUTTING	W
9.	WEED CUTTING STOP	Q
10.	SEED SOWING (for 1-feet distance)	1
11.	SEED SOWING (for 2-feet distance)	2
12.	SEED SOWING STOP	X

CONCLUSION AND FUTURE SCOPE

Technology for making farm machinery is called agricultural technology. Machines are built for almost every agricultural step. These machines plow soil, sow seeds, irrigate land, cultivate crops, protect them from pests and weeds, harvest, thresh grain, and sort goods. Agricultural engineers develop farm machinery, equipment, and buildings. “Multipurpose Agriculture Electric Tractor” was conceived and built successfully. A prototype module is built for live demonstration and yields good results. The demo module cannot be utilized for practical applications, but it may be transformed into a functional machine with simple mechanism changes. To operate, the machine must plant the seed at a certain depth in the soil, which requires force. Higher-rating motors are recommended, or hydraulic technology may be used to drive the seed container pipe into the earth. Widening the planting mechanism plants more seeds in one row faster. The machine runs at low speed; high RPM DC motors with high torque for position control or stepper motors may improve this speed. The machine is designed with a microcontroller unit, so functions are minimized. More microcontroller units with higher memory powers can be added to the system to add features like counting and displaying planted seeds, adjusting machine speed, etc.

FUTURE SCOPE

Multipurpose agricultural vehicles will revolutionize farming in the future. These robots are intended to help solve agricultural problems as technology advances. Precision agriculture uses robots with enhanced sensors and vision to plant, weed, apply pesticides, and harvest with unmatched accuracy. Mitigating agricultural labor shortages drives the future scope. Multipurpose agricultural robots automate laborious chores to address the shortage of competent farm workers. It improves operational efficiency and solves workforce issues.

These robots are intended to become autonomous systems that can navigate and complete tasks without human assistance. This autonomy should maximize resource use, save operating costs, and provide farmers more freedom.

Agriculture robots may help maintain farming in the future. These robots reduce environmental impact and promote eco-friendly farming by accurately administering fertilizers and insecticides depending on soil health and crop circumstances.

REFERENCES:

The following are the references made during design, development and fabrication ofthe project work.

1. C. H. Chavan and P. V. Karande, "Wireless Monitoring of Soil Moisture Temperature & Humidity Using Zigbee in Agriculture", International Journal of Engineering Trends and Technology (IJETT), vol. 11, May 2016.
2. Trupti A. Shinde and Jayashree. S. Awati, "Design and Development of Automatic Seed Sowing Machine", International Journal of Electronics and Communication Engineering - *(ICRTESTM)*, pp. 40-44, April 2017.
3. Nikita Chame, Mamta Jadhav, Priyanka Tele and Snehal P. Hon, "Design and Implementation of Automatic Seed Sowing Robot", International Journal of Research in Engineering Science and Management, vol. 1, pp. 102-103, May 2018.
4. J. Rajesh, R. Dinesh, S. Gowtham and K. Iniyavan, "Autonomous Adjustable Pesticide Spraying Device for Agricultural Application", International Research Journal of Engineering and Technology, vol. 06, pp. 4572-4577, Mar 2019.