STM JOURNALS

International Journal of
Advanced Robotics and
Automation Technology

Volume 2, Issue 1, 2024
January—June
DOI (Journal): 10.37591/IJARAT

https://journals.stmjournals.com/ijarat

Research IJARAT

# Modernizing Agriculture: The Evolution of a Multipurpose Farm Machine

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***Abstract***

*In India, a nation reliant on agriculture, 70% of the population makes their living from farming. However, we can see that as the population grows, the farm is divided up among the individuals; as a result, Indian farmers often own just two acres of land. Farmers also practice traditional farming since they are extremely poor and cannot afford to buy tractors or other expensive equipment. In general, bullocks, horses, and he-buffaloes are also used by many Indian farmers for agricultural purposes. Compared to other economies, this will not meet the energy needs of the farming industry. As a result, we have created a machine that uses many different kinds of mechanisms to carry out several tasks, saving small-scale farmers time and money by cutting out the need for manual and animal labor. We employed the water sprayer, leveling attachment, seed sowing attachment, and plowing rod in this equipment. It is used in small-scale farming to carry out tasks, including field leveling, water spraying, seed sowing, and plowing. This equipment has the extra benefit of a manual drive for operation. With the aforementioned accessories, one might finish a variety of farming tasks faster, cheaper, and with less labor resources.*

**Keywords:** *Kolapani yantra*, water feeding, fertilizer spraying, seed sowing, leveling attachment, grass cutting

## INTRODUCTION

The science and skill of breeding plants and animals is known as agriculture. The primary factor in the beginnings of sedentary human civilization was agriculture, and it enabled people to dwell in cities by producing surpluses of food from the farming of domesticated species. The concept of “robotic agriculture,” which involves agricultural settings operated by intelligent machinery, is not new. Several engineers have attempted to create autonomous tractors in the past, but their efforts have failed because they were unable to accept the complexity of the real-world setting [1].

The majority of them had a thought of farming in an industrial setting, where everything was predetermined and equipment could only operate in certain ways, much like on a manufacturing line. The current strategy is to create ever intelligent devices that can function in a semi-natural or unaltered environment.

The planning and build of this multifunctional farming tool equipped mobility cycle was completed with the unique requirement of lowering cultivation costs and eliminating pollution from agricultural land in our community in mind [2]. Thus, we created a vehicle whose function or application centers on other farm-based machinery, such as tractors, and whose motion is based on the

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Received Date: June 04, 2024
Accepted Date: June 25, 2024
Published Date: August 30, 2024

**Citation:** D.B. Shelke. Modernizing Agriculture: The Evolution of a Multipurpose Farm Machine. International Journal of Advanced Robotics and Automation Technology. 2024; 2(1): 1–6p.

cycle notion. Basically, we can utilize our built truck for water feeding and plowing. Spraying fertilizers, planting seeds, leveling attachments, and mowing grass all happen without burning any fossil fuel.

Since there is more market and more agricultural goods being produced, farmers must be extremely efficient in order to remain competitive [3]. Simultaneously, consumer and legislation demands for reduced usage of fertilizers and pesticides are growing. As a result, farmers must employ advanced technology in the fields to do tasks like spraying and weeding. Previously, weeding was done by hand, but nowadays, finding enough workers to complete the task is both difficult and wasteful.

The concept of using robotics to assist farmers is very new. There are countless prospects for robot-enhanced productivity in agriculture, and more and more robots show up on farms in different forms. Anticipate autonomous agricultural tasks like mud closure, water spraying, seed sowing, and plowing to get carried out by robots. Observing the daily activities of farms has been determined to be the first feasible practical application, which includes crop planting, plant maintenance, and the process of selective harvest.

In this study, the planning, building, and development of a robot that can dig dirt, plant seeds, level muck, and spray water is the main focus. The robot's whole system runs on solar and battery power. Over 40% of the global population selects farm as their major vocation, and interest in the development of autonomous cars for agricultural has surged recently. The goal of this project is to develop, reduce the amount of labor that farmers must do, speed up the process, and raise the productivity of agriculture [4–6].

The goal of this study is to construct a robot that can carry out tasks including fertilization, irrigation, and autonomous seeding. In addition, it offers both auto and manual control. The Arduino, which oversees every step of the process, is the primary element in this setup. At the moment, robots are being used more and more to assist people in their job, particularly when it comes to monotonous chores.

## AIM OF THE PROJECT

Multipurpose agricultural machinery focuses primarily on the fundamental issues that other farmers encounter; for example, *kolapani yantra*, water feeding, grass shaving, seed sowing, and fertilizer spraying.

## NEED OF MACHINE

Indian farmers in rural areas and smaller farms would benefit from the design of the multifunctional crop cultivation machine. It will assist to raise the economic status of an Indian farmer by lessening the cost of crop cutting, using pesticides, and seed feeding. The mechanical structures and tools used in farming and other agricultural activities are referred to as agricultural equipment. These instruments come in a variety of forms, from power and hand tools to tractors and the innumerable varieties of agricultural implements they drive or tow. Both organic and nonorganic farming employs a wide range of equipment [7]. A vital component of the world's food supply is agricultural machinery, particularly with the introduction of automated cultivation.

## OBJECTIVE

The goal of this project is to equip farmers with useful equipment that combines all scientific farming requirements and technology to produce crops of the highest quality and greatest yield while requiring the least amount of labor and consumption. Many tractor-powered pieces of equipment are only practical and cost-effective on properties larger than five acres. Many of the hand-pulled tools are exclusively meant to be used in gardening. Our goal is to create animal-powered equipment that is affordable and up to date using scientific methods, ideal for areas that span from one to three acres. The majority of Indian farmers possess between one and three acres of land. As a result, it works well with Indian farming methods and economies.

 

## ELECTRIC COMPONENTS

- 12-V DC battery
- Electric wire
- On/off switches
- 12–24 V diaphragm water pump
- LED strip light
- 12 V DC motors
- Wire casing pipe

## OTHER COMPONENTS

- Mild steel square hollow section (MS SHS) 12 × 12 × 1.5
- Wheels (diameter 80 mm)
- Flexible plastic pipe
- Water tank (12 L capacity)
- M-seal
- Plumbing material (1” pipe, on/off cock)

## DESIGN AND FABRICATION

Solid Works software is implemented to develop three-dimensional models, whereas Auto-Cad software is employed for designing two-dimensional models [8].

Mild steel 12 × 12 × 1.5 mm square hollow tubes were employed to construct the construction. Mild steel SHS is used because it is less expensive and helps to make structures weigh less. Using premium components will undoubtedly lengthen the machine's lifespan (Figure 1). The whole construction is 3 feet high, 1.5 feet wide, and 2.5 feet long. Here, the structure will move manually, forcing workers to push it [9].

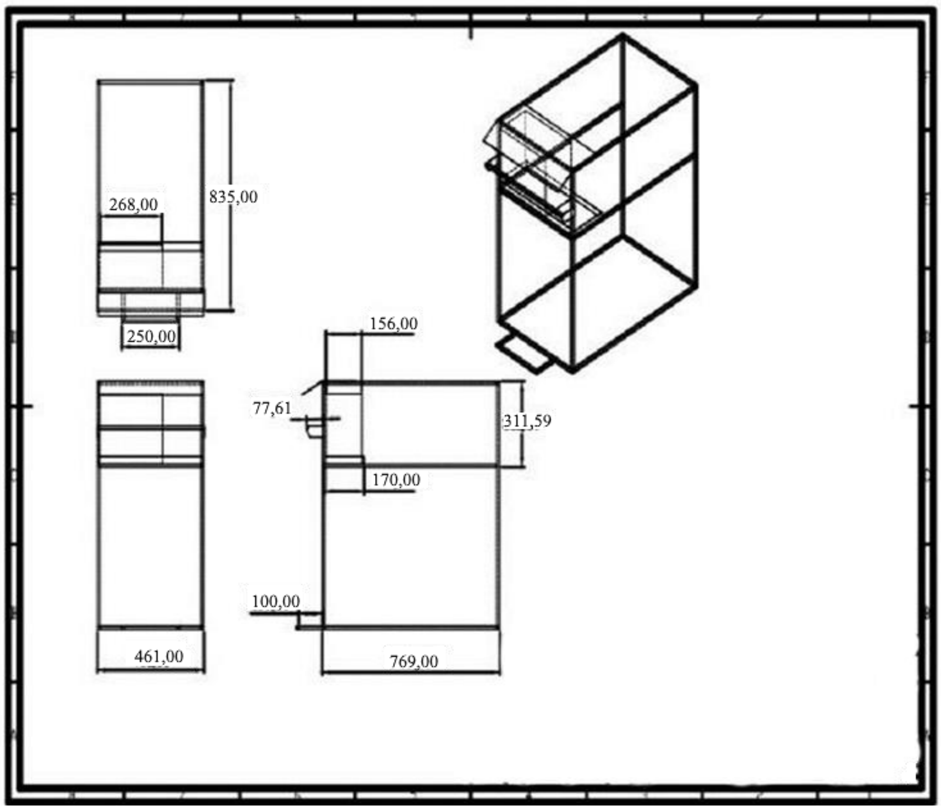


**Figure 1.** Auto-Cad software.

 

## CONCEPTS

### Seed Feeder Box

A feeder box is a place to store grains for spreading. The feeder box is 280 by 150 by 200 inches. The feeder box is constructed from 1.2 mm thick MS sheet. It has a 4-kg storage capacity. Here, we offer a flour-mill-style grain-dropping proposal. Grain outflow uses plastic pipes with a 16 mm diameter.

### Water Tank

Because MS sheet metal makes it far easier to fabricate, it is employed. The water tank is 300 by 260 by 120 mm. Its approximate water storage capacity is 12 L. With the aid of a 1-inch plumbing line and an on/off cock, we installed a water feeding idea at the bottom of the tank. The water can potentially be readily dropped on farmland because of the holes made in the pipe [10].

### Leveling Plate

An MS plate that has been attached to the rear of the building serves as the leveling apparatus. It helps to level the land and get rid of undesired dirt. This plate has a thickness of 2 mm and is manufactured of MS sheet.

### Fertilizer Sprayer

For the purpose of administering pesticides to crops, we use a high-pressure bottle spray here. The brass nozzle on this spray allows you to control the pressure. Here, this has been attributed this spray to the reverse osmosis (RO) purifier's water pump. It operates on 1.0 A of current and 12 V DC. An 8 mm diameter plastic tubing is used to connect the pump to the spray.

### *Kolapani Yantra*

This idea is applied to better farm agriculture by freeing the soil. Free soil allows plant roots to more readily penetrate the ground, strengthening crops. It indirectly leads to higher farm output. Here, we employed a 1-inch L-shaped MS angle, which was positioned along the length with the aid of hinges to allow enabling soil engagement and disengagement.

### Grass Cutting

It is employed to trim unwanted noise grass that grows on farms or other properties. It indirectly aids in staff reduction and money savings for *Tamasha*/*Tannashak*. In this particular example, we utilized a 12-V DC motor with a 2.6 A current and 7000 rpm. With the aid of L-shaped brackets, these motors were soldered to the front side of the frame. We also supplied cutting blades in the shape of rectangles. These blades have a 1.5 mm thickness and consist of aluminum sheet. Since aluminum weighs less than MS, we used it in this instance. The blade is 120 × 25 × 1.2 mm (Figure 2).

## WORKING PROCESS

*Cutlass:* The blade serves on the flanges with an effective frictional angle composed of the land surface. The blades are prepared for sowing after being sliced to the greatest degree of soil [6]. Shell cover: This is the metallic half-cylindrical cover for the rotor, which shields it from dangerous dust and stones. It makes it possible for the driver to operate effectively in a hygienic setting. The rotor assembly requires bearing support during operation because a bearing that runs smoothly can increase efficiency and reduce power loss.

We shall use a dual pedestal type roller bearing to handle the rotor's load. Sprocket and chain: For power transmission, we need a high transmission power rate with low losses. Chain and sprocket transmission systems provide the highest locking propensity and the best rate of power transfer over the shortest distance.

*Supporting arm:* To support an entire digging assembly, we employ a 1-inch MS bar. The arms are built to have the necessary weight carrying capability, so they can tolerate disturbances and shocks and offer support to stop an accident. Mechanism for the adjustment: Changes in farms and types of soils need adjusting the rotor mechanism level in the machine. This mechanism aids in regulating the cutting depth to the farmer's specification.


**Figure 2.** Actual demo picture.

The mechanism making use of MS “L” shaped angles that thread key on to itself and a body frame with holes drilled into it. These holes allow for easy adjustment of the up and down location, and the entire support is fixed with a nut on one side [4]. Sowing mechanism: When seeds are sown, they are placed in the soil. This machine works manually, and the energy required to run it is transformed into the needed produce.

The *Kolapani Yantra* idea falls into touch with the agricultural field's surface as the machine is pushed, making the soil to be ploughed. when this procedure is carried out. This versatile agricultural tool offers a number of benefits, including decreased employee costs, ease of use and affordability for small-scale farmers, and less need for humans to participate.

## CONCLUSION

All of the multifunctional agricultural machine's details were covered in this study. The issue of using too many laborers and resources may be resolved since this machine will streamline the procedure into a single step. The use of battery-powered motors reduces the amount of time needed to do the task. This method, which is machine-controlled, is safer, more efficient at managing time, and very successful. It is far more dependable and cost-effective than the traditional technique.

Compared to the conventional farming processes, which needs the effort of both humans and animals, less labor must be done.

In comparison to expensive, high-end equipment, the machine is simple to manufacture. Because of this, there are several labor and financial benefits to employing this equipment in small-scale farming.

**REFERENCES**

1. Tillett ND, Hague T, Marchant JA. A robotic system for plant scale husbandry. J Agric Eng Res. 1998; 69: 169–178.
2. Zanwar SR, Kokate RD. Advanced agriculture system. Int J Robotics Automat. 2012; 1 (2): 107–112.
3. Chame N, Jadhav M, Tele P, Hon SP. Design and implementation of automatic seed sowing robot. Int J Res Eng Sci Manage. 2018; 1 (5): 102–103.
4. Keerthana A, Kirubaharan P, Krishnamoorthy S, Rajeswari K, Zabiyullah GS. Agriculture robot for seeding and forming. Int Res J Eng Technol. 2018; 5: 3837–3840.
5. Sinduja K, Jenifer SS, Abishek MS, Sivasankari B. Automated control system for poultry farm based on embedded system. Int Res J Eng Technol. 2016; 3 (3): 620–624.
6. Malde H, Masekar M, Panchal D, Walvekar P. Automatic plant monitoring and control system. Int Res J Eng Technol. 2020; 7 (4): 6269–6273.
7. Wijanarko A, Nugroho AP, Kusumastuti AI, Dzaky MAF, Masithoh RE, Sutiarso L, Okayasu T. Mobile Mecavision: automatic plant monitoring system as a precision agriculture solution in plant factories. IOP Conf Ser Earth Environ Sc. 2021; 733 (1): 012026.
8. Sharma S, Borse R. Automatic agriculture spraying robot with smart decision making. In: Corchado Rodriguez J, Mitra S, Thampi S, El-Alfy ES, editors. Intelligent Systems Technologies and Applications 2016. Advances in Intelligent Systems and Computing, vol 530. Cham, Switzerland: Springer; 2016. pp. 743–758.
9. Steward B, Gai J, Tang L. The use of agricultural robots in weed management and control. In: Billingsley J, editor. Robotics and Automation for Improving Agriculture. Sawston, UK: Burleigh Dodds Science Publishing; 2019. pp. 161–186.
10. Edan Y. Design of an autonomous agricultural robot. Appl Intell. 1995; 5: 41–50.