Dr.T.Sengolrajan, 2023, 11:2
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

International Journal of Science, Engineering and Technology

An Open Access Journal

Design and Implementation of Controller for Effective Seed Sowing and Counting Machine

Dr.T.Sengolrajan[1], S.Jawahar[2], P.Jeevarathinam[3], G.Praveen[4]
Associate Professor, Department of Electrical and Electronics Engineering,
Kongunadu College of Engineering and Technology (Autonomous), Thottiam, Tiruchirappalli, Tamilnadu, India[1]
UG Scholar, Department of Electrical and Electronics Engineering,
Kongunadu College of Engineering and Technology (Autonomous), Thottiam, Tiruchirappalli, Tamilnadu, India[2,3,4]

Abstract- In the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labor, hiring of equipment. Design and implementation of controller for effective seed sowing and counting machine employs the latest IoT technology to automate the manual seed counting making it easier and faster. The machine integrates sensors and microcontrollers to monitor and control the seeding process in real-time, while also providing data on the number of seeds sewn. The data is transmitted wirelessly to a remote monitoring device, allowing farmers to monitor and manage their crops from anywhere, at any time. This design is very cost effective and reduce the cost of farming. The automatic seed sewing and counting machine is a promising solution to help farmers increase their accuracy and crop yields, while also reducing the risk of manual errors and labor costslife.

Keywords- Automatic Seed Sowing, IoT-Based Agriculture, Seed Counting System, Precision Farming, Smart Farming Automation.

I. INTRODUCTION

Agriculture plays a vital role in supporting the global economy, and technological advancements have significantly transformed traditional farming practices. One such innovation is the Automatic Seed Sowing and Counting Machine designed to optimize the seeding process, reduce labour dependency, and enhance operational efficiency. The conventional method of seed sowing is time-consuming, labour-intensive, and prone to manual errors, leading to uneven seed distribution and increased costs. This project introduces a smart, automated solution that integrates Internet of Things (IoT) technology with advanced sensors and microcontrollers to streamline the seeding process.
The machine ensures precise seed placement while simultaneously counting the seeds in real-time. The data collected is wirelessly transmitted to a remote monitoring system, allowing farmers to track seeding performance effortlessly. By automating this process, the machine significantly reduces labour costs, minimizes seed wastage, and ensures uniform crop growth, thereby improving overall productivity. This cost-effective solution empowers farmers to adopt precision agriculture techniques, increasing crop yields while conserving resources. The implementation of such innovative technology not only enhances agricultural efficiency but also contributes to sustainable farming practices for the future.

Agriculture is the backbone of many economies, providing food and resources for a growing global population. However, traditional farming methods, particularly seed sowing, often involve labour-intensive processes that demand significant time, effort, and resources. Manual seed sowing is not only time-consuming but also prone to errors such as uneven seed distribution, inconsistent seed depth, and wastage. These challenges contribute to reduced crop yields, increased operational costs, and inefficiencies in farm management.

To address these challenges, this project presents an Automatic Seed Sowing and Counting Machine that leverages modern Internet of Things (IoT) technology to automate and optimize the seed sowing process. The machine integrates advanced sensors, microcontrollers, and wireless communication modules to provide real-time monitoring, accurate seed placement, and precise seed counting. By automating these tasks, the system reduces the need for manual labor, minimizes seed wastage, and ensures uniform plant growth, ultimately enhancing agricultural productivity.

The proposed system operates with a controlled seed feed rate to ensure consistent seed spacing and depth, which are critical factors for optimal crop growth. Sensors continuously monitor the sowing process, and the collected data is transmitted wirelessly to a cloud-based dashboard, enabling farmers to track the operation remotely. This real-time monitoring capability empowers farmers to make informed decisions, identify irregularities, and take corrective actions promptly.
Moreover, the system is designed to be cost-effective, making it accessible to small- and medium-scale farmers. By reducing labour costs and improving sowing accuracy, this innovative machine promotes the adoption of precision agriculture techniques. The implementation of such technology not only enhances crop yields but also contributes to the long-term sustainability of farming practices.

In summary, the Automatic Seed Sowing and Counting Machine offers a smart, efficient, and reliable solution to traditional seed sowing challenges. Through IoT integration, real-time monitoring, and automation, the system simplifies farming operations, reduces costs, and supports farmers in achieving better productivity with minimal manual intervention.

II. LITERATURE REVIEW

Szymenderski et al analysed the use of piezoelectric sensors to control the movement of grain in agricultural seed machines. The piezoelectric sensor model and laboratory stand has been used for this study. Next the grading accuracy tests were carried at this stand for two seed species of the selected speed and for two sowing standards. Also selected suitable materials for optimum durability of the sensor. Grain counts are made using the ME-Red Lab PMD-1208LS measuring module connected via USB to a PC. This module has a 16-bit counter used to count beans. A special computer program was used to support this module, using features included in the Red Lab software[1].

Rashmi A Pandhare et al discussed the design and development of an automatic seed sowing machine using a microcontroller and an ultrasonic sensor. The machine uses a conveyor belt for seed sowing and the ultrasonic sensor to detect the presence of seeds on the belt. The microcontroller controls the speed and direction of the conveyor belt and the amount of seed sown. The machine also includes a display unit to show the number of seeds sown. The authors tested the machine on different types of seeds and achieved a seed sowing accuracy of over 95%[2].

Shivprasad et al implemented the design and implementation of an agriculture robot that can sow seeds and fertilize crops simultaneously. The robot uses a combination of mechanical and electronic components, including a microcontroller, stepper motors, and a fertilizer dispenser. The robot can operate autonomously or be controlled remotely using a wireless communication module. The authors conducted experiments on the robot in a greenhouse environment and achieved a seed sowing accuracy of 99% and a fertilizer spreading accuracy of 96%[3].

Keska et al illustrated the essence, prospects and research needs of precision agriculture. The author emphasizes the importance of precision agriculture in increasing crop yields, reducing costs and minimizing environmental impact. A comprehensive overview of the current state of precision agriculture, including the use of remote sensing, geographic information systems, and precision machinery. The author also identifies several researches needs in precision agriculture, such as developing advanced sensors and algorithms for crop monitoring, improving data management and analysis, and addressing the challenges of integrating precision agriculture into existing farming practices[4].

Zhang et al proposed a method for seed counting using a scale adaptive convolutional neural network (CNN). The method involves pre-processing the seed images by removing the background and enhancing the contrast. The CNN is then trained using a scale-adaptive technique that allows the model to handle seeds of different sizes. The authors evaluated the proposed method on a dataset of wheat seeds and achieved a counting accuracy of over 99%. The results demonstrate the effectiveness of the scale-adaptive CNN in seed counting applications and its potential to improve the efficiency of seed analysis in agriculture[5].

III. EXISTING SYSTEM

In this method, there is a need for a technology that is more easily understood, implemented and used by the farmers. Equipment that requires less human effort and time with less cost of implementation is much required for success in the agricultural industry. Seed sowing robot is a device that helps in the sowing of seeds in the desired position hence assisting the farmers in saving time and money. Seed sowing is one of the main processes of farming activities.

It requires a substantial amount of human efforts and also time-consuming. This project aims to design and fabrication of the smart seed sowing robot for the mentioned task. This smart seed sowing robot consists of one robotic arm to sow the seeds from the seeds container. The robot arm is controlled through the mobile application to get the desired positions of the arm. Once all the positions are set, the arm sows the seed automatically after the switching button ON. The wheel of the robot also controlled through the mobile application. Thus, this system completely automates the seed sowing process using a smartly designed mechanical system. This robot reduces the efforts and the total cost of sowing as the seeds.

Figure.1. Existing Machine Model

In the current agricultural landscape, traditional seed sowing methods predominantly rely on manual labor or basic mechanical equipment. Manual seed sowing, though simple and widely practiced, demands significant time and effort while resulting in uneven seed distribution, inconsistent sowing depth, and increased labor costs. The dependency on human labor introduces errors that can affect crop yield and efficiency. Mechanical seed drills, often attached to tractors, provide some improvements by automating the seed dispensing process. However, these machines typically lack precision in seed counting and placement, and they do not offer real-time monitoring or data tracking capabilities.

IV. DRAWBACK OF EXISTING SYSTEM

Seed sowing robots are becoming increasingly popular in modern agriculture due to their ability to automate and optimize the planting process. However, like any technology, they also have some drawbacks. Seed sowing robots can be expensive to purchase, operate, and maintain. The initial cost of acquiring a seed sowing robot can be high, and additional costs may be incurred for maintenance, repairs, and upgrades. This can pose a financial challenge for small scale farmers or farmers in developing countries with limited resources, making it less accessible to them. Seed sowing robots are complex machines that require skilled operators to operate and maintain.

Farmers need to be trained in using the robot, understanding its various components, and troubleshooting issues that may arise during operation. This can be a barrier for farmers who are not technologically proficient or lack access to proper training and support. Agricultural fields are not uniform and can vary greatly in terms of topography, soil type, and other environmental factors. Seed sowing robots may struggle to adapt to these variabilities, resulting in inconsistent planting depths, spacing, and seed placement. This can impact the overall crop yield and quality, requiring additional manual intervention to correct any mistakes made by the robot.

Different crops may require different planting techniques and equipment. Seed sowing robots may not be versatile enough to handle a wide variety of crops, which can limit their usefulness to specific types of crops or regions. Farmers may still need to rely on traditional planting methods for certain crops or in certain conditions, reducing the overall efficiency and costeffectiveness of the robot. Like any machine, seed sowing robots require regular maintenance and occasional repairs. This can add additional time and cost to the operation, and if the robot breaks down during the peak planting season, it can disrupt the planting schedule and impact crop production.

Seed sowing robots are typically designed for specific planting patterns and may not be as flexible in adapting to changes in planting configurations or patterns. If a farmer needs to adjust the planting density, spacing, or depth, it may require reprogramming or reconfiguring the robot, which can be time-consuming and complex. There are ethical concerns associated with the use of seed sowing robots in agriculture. These concerns include potential job displacement for farm laborers who traditionally perform seed sowing tasks, as well as concerns about the environmental impact of using robots in agriculture, such as energy consumption, waste generation, and potential negative effects on soil health and biodiversity.

V. PROPOSED SYSTEM

Designing of seed sowing machine

Designing a seed sowing machine involves several considerations, including the type of seeds to be sown, the soil type, the planting method, and the desired level of automation. Different seeds have different sizes, shapes, and weights, which can affect the design of the sowing mechanism. There are several types of sowing mechanisms, including the single-seed planter, the multi-row planter and the broadcast seeded. The seed hopper holds the seeds and delivers them to the sowing mechanism. The hopper design should ensure a steady flow of seeds to the sowing mechanism and prevent the seeds from clumping or jamming. A single-seed planter may use a vacuum to pick up and place individual seeds, while a multi-row planter may use a rotating drum to drop seeds into furrows. The machine should be designed to control the depth of the seeds and ensure consistent planting depth across the field. Then seed is covered by the back-end frame. Consistent, high-quality tablets that adhere to strict industry standards.

Figure.2. Design of seed sowing machine

Hopper Mechanism

The hopper is an important component of a seed sowing machine, as it is responsible for holding and delivering the seeds to the sowing mechanism. The hopper should have a sufficient capacity to hold the required amount of seeds for the planting operation. The capacity will depend on the seed type, planting density, and field size. A larger hopper can reduce the need for frequent refilling and increase efficiency. The hopper should be designed to control the flow of seeds to the sowing mechanism shown in fig 4.2. This can be achieved through the use of a metering device, such as a seed plate or seed drum, which regulates the amount of seeds released from the hopper. It ensures the steady and accurate delivery of seeds to the sowing mechanism.

Dimensions: Height-15cm, Radius-8cm, Bottom roller width-15mm, Bottom roller radius-5cm.

Figure.3. Design of hopper

Irrigation Channel Former

In garden lands irrigation channels are formed at regular intervals and then beds are formed to the required size for irrigating the crop. This is done by human labour, which consumes more time and cost. To overcome this problem a tractor drawn channel farmer to form irrigation channels was developed. The channel forming portion consists of two inner blades. At the junction of these two inner blades a cultivator shovel is fixed to penetrate into the soil.

Dimensions: length-100cm, height-30cm, blade length-10cm

Figure.4.Irrigation Channel Former

Mud Closing Frame

The mud closing framework is an essential part of a seed sowing machine. After the seed is sown, the mud closing mechanism helps to cover the seed with soil and create a favourable environment for germination. The mud closing framework usually consists of two parts: the mud closing plate and the mud closing frame. The mud closing plate is a flat plate that is placed behind the seed sowing mechanism. It helps to push the soil back to cover the seeds after sowing. The plate is typically adjustable so that the amount of soil covering the seed can be varied based on the soil type, seed size, and depth of sowing. It has a length of 100 cm and height of 25 cm.

Figure.5. Mud Closing Frame

Moving Wheel

The moving wheel is a key component of a seed sowing machine. It is usually placed in front of the seed sowing mechanism and helps to move the machine forward as the seeds are sown. The moving wheel is designed to provide smooth and consistent movement of the machine over various types of terrain. The moving wheel typically consists of a large, rugged wheel made of plastic or other durable materials that can withstand the rigors of farming operations shown in fig 4.5. The wheel is mounted on an axle, which is connected to the frame of the seed sowing machine. The axle can rotate freely, allowing the wheel to move forward and backward as needed.

Figure.6. Moving Wheel

VI. RESULT AND DISCUSSION

The seed sowing and counting machine was designed and tested to automate the process of sowing seeds and accurately counting the number of seeds sown. The machine was evaluated based on its performance in terms of seed sowing accuracy, efficiency, and ease of use. The machine demonstrated high accuracy in sowing seeds at the desired spacing and depth. The seeds were consistently sown with minimal variation in spacing and depth, resulting in uniform seed placement. The machine significantly reduced the time and effort required for manual seed sowing. It was able to sow seeds at a faster rate compared to manual sowing, resulting in increased efficiency and productivity. The machine was easy to operate, with simple controls and adjustments for seed spacing and depth. The loading and unloading of seeds were straightforward, and the machine required minimal maintenance during the testing period. In counting portion, there is some difficulties when the small seed drop is not detected well.

Fig.7[i]. Implementation of seed counter

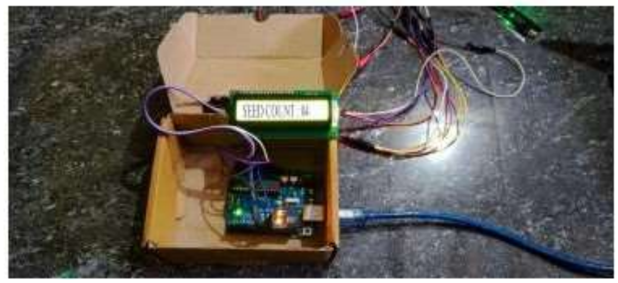

Fig.7[ii]. Seed counting controller

The seed counting controller is a crucial component in modern automated seed sowing machines, ensuring accurate seed dispensing and monitoring throughout the sowing process. It utilizes sensors, microcontrollers, and advanced algorithms to count seeds in real-time, providing precise data on the number of seeds sown. The controller typically employs optical, infrared, or capacitive sensors to detect the passage of individual seeds through the seed delivery mechanism. When a seed passes the sensor, a signal is sent to the microcontroller, which increments the seed count accordingly.

The microcontroller acts as the brain of the seed counting system, processing sensor inputs and controlling the seed dispensing mechanism to maintain uniform spacing and quantity. This real-time monitoring ensures consistent seed placement, which is critical for optimal germination and crop growth. Additionally, the seed counting controller often integrates with wireless communication modules to transmit data to a remote dashboard, allowing farmers to monitor seed count and sowing performance from anywhere.

Fig.7[iii]. Seed covered at end

Based on the results, the seed sowing and counting machine proved to be a reliable and efficient solution for automating the seed sowing process. It demonstrated high accuracy in seed placement, increased efficiency in seed sowing, and was easy to use. The machine has the potential to significantly improve the precision and productivity of seed sowing operations in various agricultural settings, such as nurseries, greenhouses, and large-scale farms. However, it should be noted that the results may vary depending on factors such as seed type, soil conditions, and machine settings. Further testing and optimization may be required to fine-tune the machine for specific seed types and planting conditions. Overall, the seed sowing and counting machine shows promise as a valuable tool for modern agriculture, offering potential benefits in terms of time, labour, and accuracy in seed sowing operations.

VII. CONCLUSION

The main focus of this system is its Automatic way of sowing the seeds in a row. The seeds are been sowed in a proper sequence which results in proper germination of seeds. This automatic way of sowing seeds using a simple mechanism reduces the labour requirement. Here the wastage of seeds is also been reduced to a greater extent. This system has been developed for the counting of seeds in an automatic way. Here with the help of a controller the seeds have been counted before drop in the soil in a proper sequence hereby reducing the wastage of seeds. The planting process of the groundnut crop only has been implemented by using this Seed Sowing and counting machine. This mechanism will help the farmers to do the farming process efficiently. The project can be enhanced to any other kinds of crop such as fruits, paddy, sugarcane etc. Hence, it can be applicable to the real time agricultural field.

REFERENCES

1. Szymenderski, L. Gierz, D. Wojcieszak and K. Koszela,(2019) 'Testing of electrical signals from piezoelectric sensors in application for counting grains in seeding machine,' 19th International Conference Computational Problems of Electrical Engineering, Banska Stiavnica, Slovakia, pp. 1-4, doi: 10.1109/CPEE.2018.8506916.
2. Rashmi A Pandhare and Tejas Padathare, (2021) 'Design and development of automatic operated seed sowing machine', International Journal of Recent and Innovation Trend in Computing and Communication, vol. 5, no. 2.
3. B. S. Shivprasad, M. N. Ravishankara and B. N. Shoba,(2022) 'Design and implementation of seeding and fertilizing agriculture robot', International Journal of Application or Innovation in Engineering & Management, vol. 3, no. 6.
4. W. Kęska, (2022) 'O istocie perspektywach i potrzebach badawczych rolnictwa precyzyjnego', Journal of Research and Applications in Agricultural Engineering, vol. 47, no. 2, pp. 4-7.
5. L. Zhang, M. Shi and Q. Chen,(2022) 'seed counting via scale- adaptive convolutional neural network', Proc. IEEE Winter Conf. Appl. Comput. Vis., pp. 1113–112.
6. Mazhar Kara, Bahadir Sayinci, Erdal Elkoca, Irfan Ozturk and T.B. Omzen, (2021) 'Seed Size and Shape Analysis of Registered Common Bean (Phaseolus vulgaris L.) Cultivars in Turkey Using Digital Photography', Journal of Agricultural Science, Vol. 19 (3), 219–234.
7. M. Aravind kumar, Akkarapalli Sanjeev Reddy and K. Sagadevan (2019) 'AUTOMATIC SEED SOWING & IRRIGATION AGRIBOT USING ARDUINO', International Journal of Pure and Applied Mathematics, vol. 119, no. 14. 39
8. S. Umarkar and A. Karwankar, (2019)'Automated seed sowing agribot using arduino', 2016 International Conference on

Communication and Signal Processing (ICCSP), pp. 1379-1383.

9. H Song and H. Liang, (2019), 'Vision-based seed detection and counting system using deep learning', European Transport Research Review, vol. 11.1, no., pp. 51.
10. Chadalavada Hemadri, (2021), 'Solar powered semi-automated mutlipurpose agriculture machine', Materials Today: Proceedings, vol. 46, pp. 3469-3473.
11. Li Zhiwei, Wang Jianlock, Qin Jiping et al., (2021), 'The study of precision seeder monitors [J]', Journal of Shanxi Agricultural University, no. 4, pp. 392- 39, 2021.
12. Chen Quan, Cheng Wei, Liu Xiaotan et al., 'Research and Application of Portable Plate Automatic Seeding Machines [J]', Sichuan Agriculture and Agricultural Machinery, vol. 43, no. 6, pp. 22-23,
13. J. Zhang, Z. Zhao and G. Chi, (2021) 'The design and research of multifunctional intelligent sharing seeding machine,' 2021 International Conference on Artificial Intelligence and Electromechanical Automation (AIEA), Guangzhou, pp. 57-61, doi: 10.1109/AIEA53260.2021.00020.
14. A Golakotta and M. B. Shrinivas, (2022), 'Agribot-A multipurpose Agricultural robot', India Conference (INDIACON} 2011 IEEE Annual conference, pp. 1-4.
15. A. Nishiki, T. Nomoto, I. Abiko and K. Kaminishi, (2021), 'A 1148 x 3 x 800 dot 14-in. TFT color LCD with improved lateral field effect', Conference Record of the 1991 International Display Research Conference, San Diego, CA, USA, pp. 239-242, doi: 10.1109/DISPL.1991.167479.
16. N. Kamal and N. Ishak, (2021), 'Implementing Smart Counter to Support Seed', 2021 IEEE 12th Control and System Graduate Research Colloquium (ICSGRC), Shah Alam, Malaysia, pp. 244-247, doi: 10.1109/ICSGRC53186.2021.9515300