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# Autonomous Seed Sowing Bot - A Survey

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**Abstract:** The demand for sustainable agricultural practices has led to the development of advanced technologies in precision agriculture. This research presents the design and implementation of a simple follow-me bot that serves as a seeder and uses ultrasonic sensors, Arduino microcontrollers, and servo motors. The goal of this research is to automate the process of seed placement, increase efficiency, and reduce human labor. The proposed system uses ultrasonic sensors to detect obstacles and determine the optimal path for the Follow-Me-Bot. By integrating the Arduino microcontroller with the sensors, real-time data acquisition and processing is achieved, allowing the bot to navigate through the designated area while avoiding potential obstacles. In addition, servo motors are used to actuate the seed placement mechanism and ensure precise and consistent seed placement. This research outlines the methodology used to design the follow-me bot and provides a detailed description of the hardware components and their interconnections. The programming logic and algorithms used to control the bot movement and seed delivery mechanism are also discussed, highlighting the seamless integration of the ultrasonic sensors and servo motors with the Arduino platform. Experimental results demonstrate the effectiveness of the proposed system, as the Seed Sower bot successfully navigates through an obstacle course while accurately sowing seeds. The bot's ability to adapt to changing environmental conditions and efficiently perform seeding demonstrates its potential for automating agricultural operations and improving productivity. This research is significant as it lays the foundation for the development of advanced autonomous agricultural systems. The integration of sensor-based navigation and precise seed application mechanisms paves the way for future innovations in precision agriculture and provides a sustainable solution to optimise crop production while reducing labor-intensive processes.

**Keywords**: follow me bot, seed drill, ultrasonic sensors, Arduino microcontroller, servo motors,automation, precision agriculture, sensor based navigation, autonomous agricultural systems.

## I. INTRODUCTION

In today's rapidly evolving world, technology is constantly changing various industries, and agriculture is no exception. Over the years, farmers and agricultural experts have embraced automation to increase efficiency, reduce labor-intensive tasks and optimise crop production. One of the latest innovations revolutionising the agricultural landscape is the introduction of Follow Me Bots as seeding machines. These intelligent robots, equipped with state-of-the-art navigation systems, are designed to help farmers sow seeds accurately and on time. Using artificial intelligence, GPS technology and advanced sensors, Follow Me Bots have become an indispensable tool for modern farmers, leading to higher productivity and sustainable farming practices.

The concept behind Follow Me Bots is simple, yet so effective. These autonomous machines areprogrammed to follow a specific farmer or operator across the field, faithfully mimicking their every move. With their high-precision positioning systems, these bots ensure that seed is sown in precisely defined locations, optimising planting patterns and minimising waste. Traditionally, seeding is a labor-intensive and time-consuming process that often requires manual labor or the use of large machinery. However, with Follow Me Bots, farmers can significantly reduce labor and operating costs. These autonomous seeders can cover large areas efficiently and effectively, improving overall farm productivity while freeing up valuable human resources for other importanttasks.

In addition, Follow Me bots provide unmatched precision in seed placement, resulting in uniform seed distribution and better plant growth. By maintaining uniform seed spacing and depth, these robots enable optimal seed germination and minimise competition between plants for resources, ultimately resulting in higher crop yields. In addition, the real-time data collection capabilities of these robots provide growers with valuable insights into soil conditions, moisture content and other key environmental factors,allowing them to make data-driven decisions to maximise crop health and yield.

The use of Follow Me bots in agriculture is also in line with the growing demand for sustainable farming practices. These smart robots are able to apply fertilisers, pesticides and other necessary inputs exactly where they are needed,

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minimising chemical use and reducing environmental impact. In addition, their autonomous operation reduces fuel consumption and soil compaction compared to conventional machines, contributing to long-term soil health and conservation.

As we explore the limitless potential of Follow Me Bots as seeding machines, this article aims to examine the technological advances, benefits and future prospects of this transformative agricultural innovation. By leveraging automation and precision agriculture, farmers can unlock new opportunities for increased yields, optimised resource use, and sustainable practices. Join us on this journey to witness the dawn of a new era in agriculture driven by intelligent robots, the Follow Me Bots.

## II. RELATED WORKS

The concept of the "follow me" bot has gained popularity in the field of robotics and artificial intelligence. While I am not aware of any specific work with this exact name, there is related work and research in the areas of mobile robots, object tracking, and human-robot interaction. Here are some notable works and references in these areas:

"Real-Time Object Tracking for Interactive Robots" by Mozerov-et-al. (2017): This work presents a real-time object tracking system for a mobile robot that uses computer vision techniques and allows the robot to follow and interact with moving objects.

"Visual Tracking Control of Mobile Robots for Human Following" by Morales et al. (2017): This work focuses on visual tracking techniques to enable a mobile robot to follow and maintain a certain distance from a human operator, using a combination of cameras and sensors.

"A Robot That Follows You: Autonomous Tracking Using Computer Vision Techniques" by Fuentes- Pacheco et al. (2016): This research explores the use of computer vision algorithms to track and follow aperson in real time, allowing a mobile robot to autonomously follow a human operator.

"Human Following Robot using Facial Recognition" by Deng and Guo (2015): This study proposes a robot that uses facial recognition to track and follow a specific person so that the robot can maintain a constant distance from the target.

"Human-Robot Interaction: A Survey" by Fong et al. (2003): Although an older reference, this survey provides an overview of various aspects of human-robot interaction, including robot behaviours such as following people.

## III. METHODOLOGY

This project aims to detect an object using ultrasonic sensors and follow it. We planned to implement this project using three ultrasonic sensors, one to detect the range and the other two to turn the bot in needed direction, to follow the object. The bot follows the human when the distance read bythe sensor is within a certain range.

The turning happens when the left and right ultrasonic sensors have a difference in reading with a certainmargin, i.e. The bot turns right when the distance sensed by the left sensor is greater than the distance sensed by the rightultrasonic sensor and vice versa.

A. **Components:** DC Motor, 12V, Ada-fruit Motor shield, Jumper wires(generic), Arduino UNO, SG90 Micro-servo motor, Ultrasonic Sensor-HC-SR04, 9V battery(generic), Micro-motors & Grippy Wheels.

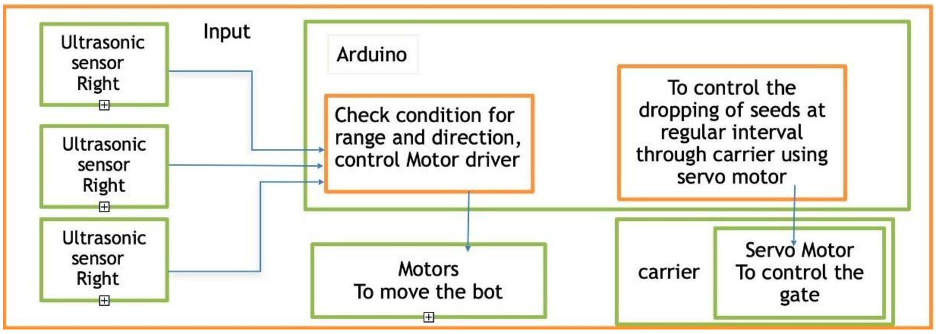


Fig. 1: Block diagram

  

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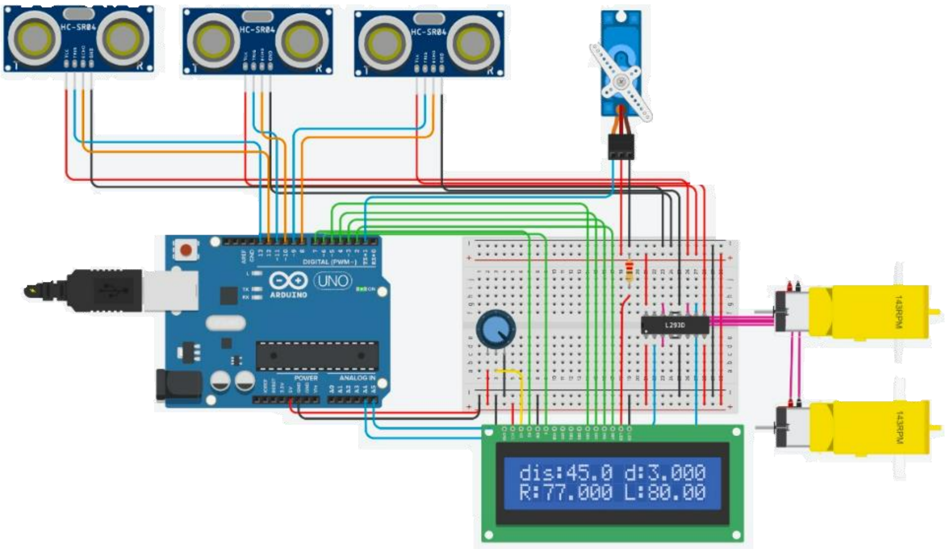


Fig. 2: Digital Circuit

B. **Construction:** A motor driver, an Arduino and three ultrasonic sensors along with a breadboard are mounted on a chassis made of foam board of dimension 17cm X 12cm. The ultrasound sensors are connected to the digital pins of the Arduino. They are placed in three different positions of the bot front, right and left side. All these ultrasound sensors are connected to the Arduino.

A piece of foam board is attached below the chassis to hold the batteries that power the Arduino and the motor driver. There are two switches, one for the Arduino and the other for the motor driver. The motor driver is connected to two motors that help in moving the bot. In the front omni wheels are used which rotate independently. A carrier is attached in the back of the bot to carry and drop seeds. It consists of a servo motor which opens and closes a slid down the carrier, this allows the dropping of the seed.

## IV. RESULT

The Seed Sower Bot, successfully proved its capacity to follow human motion and plant seeds autonomously. The robot through the integration of a number of components and mechanisms, including a forward-facing tracking mechanism, a rear-mounted seed hopper, ultrasonic sensors, an Arduino microcontroller, motors, motor driver and a servo motor, was able to successfully accomplish its task of sowing seeds with a good amount of precision.

The ultrasonic sensor was essential in identifying items that were within a predefined distance. The sensor gave the Arduino microcontroller real-time input by making sound waves and examining their reflections. This helped in identifying human motion and providing instructions to the Arduino microcontroller using specific codes to achieve a robot that could follow humans.

The Seed Sower started moving forward by turning on the motors connected to the motor drive when an human detected within the specified range.When the human strayed outside the specified range, therobot halted and also stoped the seed dispenser.

Once the Seed Sower started following the human, the servo motor-controlled slot on the bottom of the seed carrier opened downward at desired intervals set before hand, allowing the discharge of seeds. The slot automatically closed after a set amount of time, ensuring that the seeds were distributed effectively.This way the regulated discharge of seeds onto the ground was made easier.

The Seed Sower robot demonstrated consistent and reliable performance in sowing seeds. Its ability to precisely follow track humans and sow seeds at regular intervals showcased its potential for agricultural applications and automation in seed dispersal processes.

  

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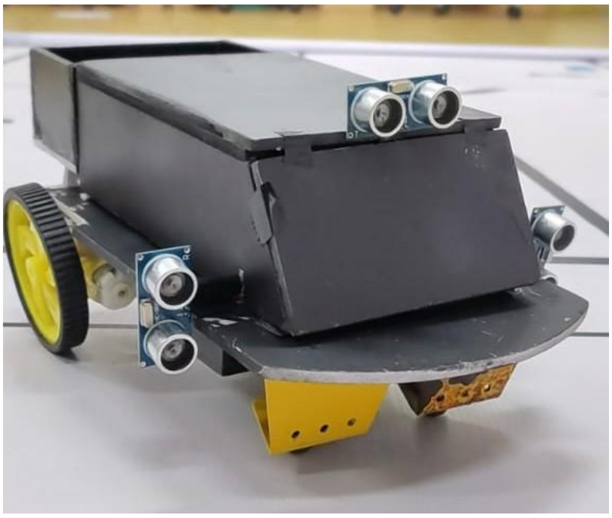

Fig. 3: Seed Sower robot

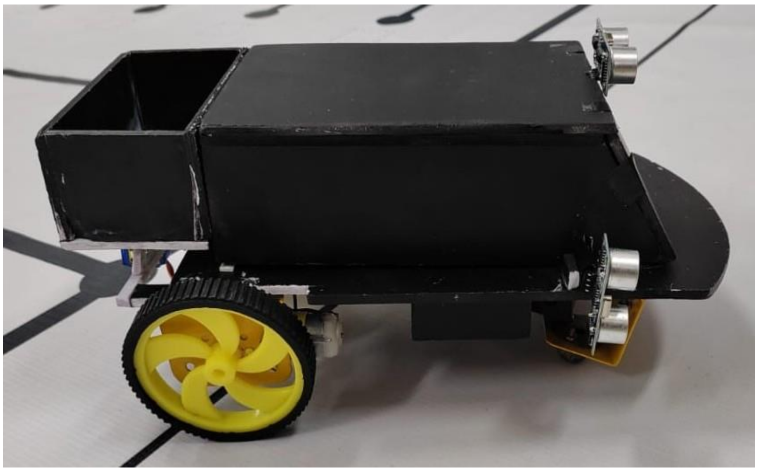

Fig. 4: Seed Dispenser attached to the back of the chaise

## V. FUTURE ENHANCEMENT

The field of robotics and automation continues to evolve at a rapid pace, pushing the boundaries of what is possible in various industries. In the realm of agriculture, Follow Me Bots have emerged as valuable tools for precise seed sowing and crop management. To further enhance the capabilities of these autonomous companions, the integration of ultrasonic sensors holds tremendous potential. Ultrasonic sensors utilise sound waves to measure distance, providing accurate proximity information about the surrounding environment. By incorporating ultrasonic sensors into Follow Me Bots, we can unlock a range of benefits and advanced functionalities that can revolutionise the way we approach seed sowing and agricultural practices.

1. **Obstacle Avoidance**: Ultrasonic sensors can enable Follow Me Bots to detect obstacles, such as rocks, plants, or uneven terrain, in real-time. By equipping the bots with this technology, they can autonomously navigate around obstacles, ensuring uninterrupted seed sowing operations and minimising the risk of damage to the equipment or crops.

2. **Crop Health Monitoring**: With the ability to measure distance, ultrasonic sensors can be utilised to assess the height and overall health of crops. By analysing the reflected sound waves, Follow Me Bots can gather valuable data on plant growth, canopy density, and potential issues like stunted growth or pest infestations. This information can empower farmers to make timely decisions and take necessary actionsto ensure optimal crop health and yield.

3. **Soil Analysis**: Ultrasonic sensors can also be employed to assess soil conditions. By measuring the distance between the sensor and the soil surface, Follow Me Bots can gather data on soil moisture levels, compaction, and texture. This information can assist farmers in determining irrigation requirements, optimising nutrient application, and implementing appropriate soil management practices.

 

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4. **Autonomous Path Planning**: Integrating ultrasonic sensors into Follow Me Bots can enable them to autonomously plan their paths based on real-time data. By detecting the proximity of nearby objects or boundaries, the bots can dynamically adjust their routes, ensuring efficient seed sowing while avoiding potential collisions or trespassing into restricted areas.

## VI. CONCLUSION

A successful implementation of a prototype of human following robot is illustrated in this paper. This robot does not only have the detection capability but also the following ability as well. While makingthis prototype it was also kept in mind that the functioning of the robot should be as efficient as possible. Tests were performed on the different conditions to pin point the mistakes in the algorithm and to correctthem. The different sensors that were integrated with the robot provided an additional advantage. The human following robot is an automobile system that has ability to recognise obstacle, move and change the robot's position toward the subject in the best way to remain on its track. This project uses Arduino, motors, different types of sensors to achieve its goal. This project challenged the group to cooperate, communicate, and expand understanding of electronics, mechanical systems, and their integration with programming.

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