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Agribot: Arduino Controlled Automatic Seed Sowing Machine for Small Scale Cultivation

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Abstract

The Agribot is a robot that reduces the efforts and total cost of sowing the seeds. A seed Sowing Machine shouldbe suitable for all farms, have robust construction, also it should be reliable, this is the basic requirement of asowing machine. Thus, we made a seed-sowing machine that is operated manually but reduces the efforts offarmers thus increasing the efficiency of planting and also reducing the problem encountered in manualplanting, we have provided a cultivator at the bottom of the robot which will be used to cultivate the land andthen the seed will fall at the fixed interval with the help of motors. For this robot, we use an Arduino forcontrolling purposes, servo motor for water sprinkler direction, DC motors to rotate the seed rotor, and also abattery to power the robot. So, in this project seed is falling at fixed intervals of time and the bot is moving at aconstant speed so that linearity in the plantation is maintained, wastage of seed is prevented and seeds will fallat uniform distances. Also, a mechanism is constructed so that after the seed falls on the ground through a seedrotor which is controlled with a DC motor and commands through a Bluetooth module a fine amount of soil iscovered on the seed, and after that water is sprinkled on it through the same bot. A mobile application is used to command the robot with the help of the Bluetooth module. On receiving the signals from the mobile application, the Bluetooth module will give data to the Arduino and then the Arduino will provide the necessary signals to the motors.

Keywords: Automation; Agribot; seed sowing; low cost; watering; faring machine; time saving; land.

INTRODUCTION

In India there are 70% people dependent on agriculture [1]. The use of innovative and modern and robust technologies helps us to achieve higher yield with less work, time and money [2]. Crop productivity needs to rise in order to stimulate the economy. The technology employed during the production and processing stages affects the volume of production in addition to capital investments and marketing plans. Modern technology are lacking among Indian farmers. While farmers are still involved in agricultural operations, their work is made easier by appropriate technology in the sector. Farmers that practice autonomous agriculture can effectively increase precision while minimizing their negative effects on the environment [3,4].

Many processes are involved in agriculture sector such as serving a and navigation of the field and maintaining the plants [5]. One of the processes that is associated with agriculture is seed sowing [6]. and nowadays a control system is also built in order to increase the efficiency in this field [7]. Thinking about how to benefit the farmers and small-scale

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greenhouse cultivators, at the same time to bring innovation to the country's agriculture mechanism we decided and succeeded in making a multi-purpose agricultural robot "AGRIBOT". This project we developed using local available materials to make it very cost effective and at the same time specialized according to our country's condition. It can do all the functions of farming; the main difference is it does all the things by itself with the on/off a button. The seed sowing procedure is automated in this model [8] in order to minimize labor costs and boost yield. A DC motor is used to autonomously plant the seeds. Using a DC motor, seed planting is done automatically. The microcontroller regulates the separation between the two seeds[9]. Reducing the number of workers in our nation is the primary goal of automation.

Low seed placement, inefficient spacing, and severe back pain for the farmer are some of the outcomes of planting seeds by hand [10]. Additionally, this reduced the amount of land that could be planted. Therefore, it is important to optimize the aforementioned constraints in order to get the most out of a seed planter. In Indian communities, planting by hand is rather common. However, this strategy is exceedingly problematic for huge scales. Furthermore, laborious planting results in increased waste.

Driven by a four-wheeled DC motor, the Agribot system is an artificial agent that is electromechanical.

Controlling part of this vehicle system is done with an Arduino. For seed sowing servo mechanism is used, also a sprinkler system is there to remove soil blocks before seed sowing for this a pump is used and servo motor.

COMPONENTS REQUIREMENT

For Vehicle Mechanism

1. 4 DC Motor
2. Wheels
3. L298 motor driver
4. 12v Battery
5. Arduino
6. Bluetooth module

For Seed Sowing

1. Two Servo motor
2. DC
3. Pump
4. Sprinkler

For Mechanical Construction

1. Wooden platform for vehicle
2. Iron clamps for sowing mechanism
3. Bottle for seeds

MODEL IDEAS

First Idea

Working

For our first idea of construction of the model was when the robot is moving that is all four wheels of the machine is moving then it should sprinkle some water so the pump will be turned on and one servo motor is on which is connected to sprinkler when all for motors of the wheel is on and when wheel stops the sprinkling will be stopped and another servo motor for seed dropping on the ground and again the process repeats. Here the robot will stop for a specific period and in a specific interval of time. This start and stop command are taken by the user through a mobile application with Bluetooth so the Bluetooth module gives data to the Arduino according to that Arduino taking action and giving command to the motors and motor driver. Figure 1

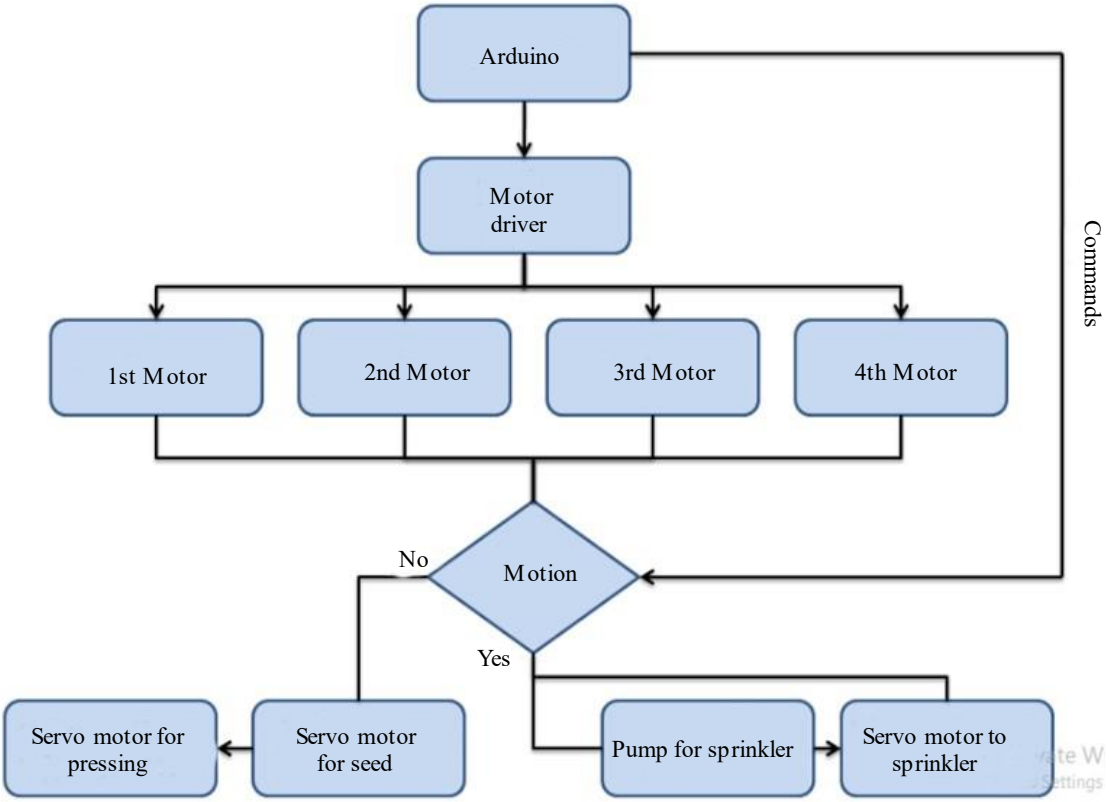

Figure 1. Flowchart of an automated agricultural system using Arduino.

LIMITATION

If the robot has to turn then two motor will be running other two will not so in that condition none of the process should work also here the seed dropping mechanism is such that more seed could fall in single through as servo motor speed must be very fast to fall only one side at a time also the problem of friction of metal as it moves that fast so it will be not long term. So, we came up with another idea of the seed dropping by using the gear mechanism and DC motor we used to rotate the gear and so that one seed will fall at a time.

Second Idea

Working

The signals will be given to Arduino according to requirements from the Bluetooth module. First command is given to Arduino for Hydraulic Mechanism using servo motor , second for car movement control ,third according to requirement water could be sprinkled in one direction or left-right movement of the sprinkler can also be performed using servo motor and forth the seed will be falling continuously or we can stop in between manually and its speed that is falling speed can be controlled by the rotating speed of the gear mechanism which is controlled by one 10 rpm DC motor. As a result, seeds will fall in line with the robot's movements. As a result, this machine will function flawlessly with any type of seed that is a specific size. Figure 2

Problem Faced and Solution

- *First:* As we used a Lithium 3.6v battery of these four batteries we used in series 14.4v but that was not sufficient to run the whole robot as it was containing heavy weight of the gear mechanism and pump, so it was not able to run the motor and also it gets discharged very early. So, then we used a 12v sealed lead-acid battery. This battery was providing sufficient voltage to drive the motors now.
- *Second:* When we kept the speed of car low some of the keys get overlapped that is when we press forward key for the forward movement of the car it was moving to the right side not forward, as speed was low and due that current passing to the motors was less. So when we increase the speed of car the problem was resolved, speed of the car can be increase or decrease from that mobile application.

- *Third:* Sometimes wires of Bluetooth module got disconnected due to the movement and connection with mobile application get lost. So now we fixed Bluetooth module on the wooden bord so it do not get disconnected and wires do not lose.

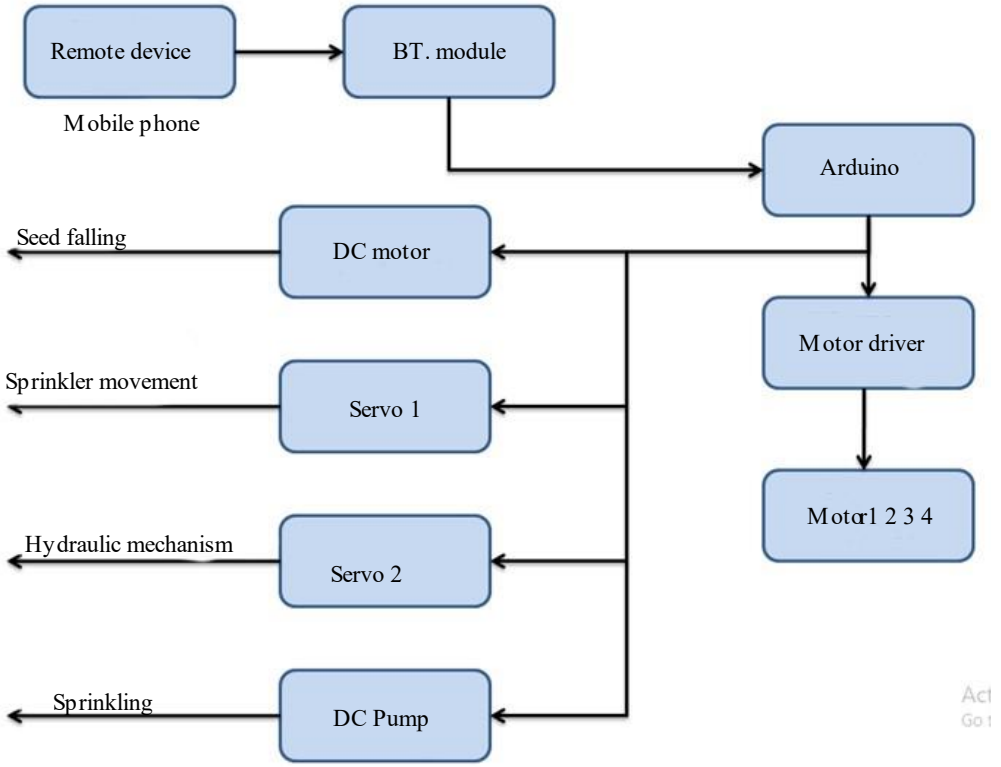

Figure 2. Block diagram of a remote-controlled agricultural automation system using Arduino.

COST AND ANALYSIS

This robot is made with very simple and cost-effective equipment. But the cost might vary due to some variable components of this robot. These variable components will vary due to the design choice of the customers, the condition of the farmland, and the size of the farmland and the availability of more efficient and cost-effective equipment. The Arduino used here is the Arduino UNO. The total cost of this robot will reduce if cheaper, cost effective and efficient Arduino is used. The type of wheels will depend on the condition of the farmland. The cost of the wheel will vary depending on what type of wheels best suits for a particular farmland. This robot is made with very simple and cost-effective equipment. But the cost might vary due to some variable components of this robot. These variable components will vary due to the design choice of the customers, the condition of the farmland, and the size of the farmland and the availability of more efficient and cost-effective equipment.

Table 1. list of Equipments and Materials for Arduino-Based Project 4o

Sr. No	Components	Quantity
1.	Arduino UNO	1
2.	12v 7Ah Chargeable Battery	1
3.	360° Servo Motor	1
4.	7404 NOT gate IC	1
5.	5 V DC Motor	4
6.	HC05 Bluetooth Module	1
7.	L298 Motor driver	1
8.	Pump set	1

10.	Extra	
11.	180° Servo Motor	1
12.	Steel rods	
13.	Wooden board	2
14	12v DC Motor (10 rpm)	1

RESULTS

FIRST STAGE

As shown in Figure.3 Four-wheel car mechanism was made for the movement of the robot in the filed which is controlled using Bluetooth module and here we first used the 4 lithium chargeable batteries.

Figure 1. Four-wheel car mechanism.

SECOND STAGE

As shown in Figure 4. as per the requirement two stage wooden platform is made so that seed falling mechanism can be adjusted and we also changed the battery from lithium to 12v Battery as that was not enough to run whole robot.

Figure 2. Two-stage adjustable wooden platform with upgraded 12v battery for seed-falling mechanism.

THIRD STAGE

As shown in Figure 5. seed sowing gear mechanism is as constructed So, disc made seed falling mechanism is rotated with DC motors and one by one seeds will get rotated as disc moves.

Figure 3. DC motor-driven seed sowing mechanism using rotating disc.

FOURTH STAGE

As shown in Figure.6 seed is being rotated and when it reaches to the funnel is falls into the funnel and then from the hole it falls on the ground. Also, at top front we kept the servo motor at which a water pipe is connected for sprinkling water.

Figure 4. Seed rotation and water sprinkling mechanism.

FIFTH STAGE

This is the final stage of the project as shown in Figure 7. in which we kept the hydraulic mechanism to cover up the seed from sand near by it. Thus the seed will be covered by this robot only we will not be needing any other machine or manual work for that.

Figure 5. Hydraulic seed covering mechanism.

BENEFITS

Benefits that is robot provides are list as below

- It is low coast and affordable.
- Adjustable seeding rate.
- No extra manpower required.
- It can be easily dismantled and portable.
- Fully controlled though remote device.
- Modified according to requirement.

CONCLUSION

This robot was made to help the farmers in their cultivation process to make it easy, modern and with new technology and tried to make as feasible as possible for poor farmers. As it is easy to handle it will be useable to all the farmers and as it is cost effective maximum farmers can utilize including poor farmers too but as it demo module it can be used for only one size of the seed and for small-scale cultivation. Additionally, it is particularly efficient at moving from one location to another. Compared to tractors and pumps, which mostly run on oil, it is more environmentally friendly because it is constructed from easily accessible and reasonably priced mechanical parts.

Acknowledgment

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