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Mulitipurpose Agricultural Robot (AGRIBOT)

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ABSTRACT: Agriculture is one of the oldest forms of occupation. The use of tools and livestock in the agricultural process has reduced the human effort. The automation of agriculture refers to the use of tools or machines in the agricultural process that potentially reduces the human effort. Although it reduces the human effort in the agricultural process, it requires human interaction. The automation and robotics application in the branch of agriculture is at the booming stage when compared to its wide range of application in other sectors. Agribot is a robot designed for agricultural purposes. It is designed to minimize the labour of farmers in addition to increasing the speed and accuracy of the work. Aimed at increasing the productivity and reducing the labour involved, this robot is designed to execute the basic functions required to be carried out in farms. We aim to create a multitasking agriculture robot which will focus on basic work of plantation and fertilisation without any human intervention. The robot developed is capable of making a hole in the soil up to certain depth, placing the seed accurately in the same hole. The right amount of fertilizer will be spread over the seed. The process is controlled by a microcontroller. The robot developed overcomes the drawbacks in the traditional method of seeding which includes wastage of seeds, high labour wage, lower utilization of land etc. By the application of automation and robotics in the field of agriculture it is possible to increase the overall efficiency of the agricultural process and can mitigate effects of labour shortage.

KEYWORDS: Automation, Seed plantation, Fertilizer Spraying

I. INTRODUCTION

Agriculture plays a very important role in India's economy. The use of tractor is most common in the current agricultural trends. This requires a lot of energy and human interaction. The need for the automation in the field of agricultural sector is mainly due to the increased need of agricultural products, increased population and shortage of labor in the agricultural sector. Robotics is the branch of technology that deals with the design, construction, operation, and application of robots, as well as computer system for their control, sensory feedback, and information processing.
India record of progress in agriculture over the past four decades has been quite impressive. The agriculture sector has been successful in keeping pace with rising demand for food. The contribution of increased land area under agricultural production has declined over time and increases in production in the past two decades have been almost entirely due to increased productivity. Contribution of agricultural growth to overall progress has been widespread. Increased productivity has helped to feed the poor, enhanced farm income and provided opportunities for both direct and indirect employment. The success of India's agriculture is attributed to a series of steps. The major sources of agricultural growth during this period were the spread of modern crop varieties, intensification of input use and investments leading to expansion in the irrigated area. In areas where 'Green Revolution' technologies had major impact, growth has now slowed. New technologies are needed to push out yield frontiers, utilize inputs more efficiently and diversify to more sustainable and higher value cropping patterns". At the same time there is urgency to better exploit potential of rain fed and other less endowed areas. Given the wide range of agro ecological setting and producers, Indian agriculture is faced with a great diversity of needs, opportunities and prospects. Future growth needs to be more rapid, more widely distributed and better targeted. These challenges have profound implications for the way farmers' problems are conceived, researched and transferred to the farmers. "On the one hand agricultural research will increasingly be required to address location specific problems facing the communities on the other the systems will have to position themselves in an increasingly competitive environment to generate and adopt cutting edge technologies to bear upon the solutions facing a vast majority of resource poor farmers. The robotic systems play an immense role in all sections of societies, organization and industrial units.

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II.SYSTEM MODEL

The robot that is developed is capable of making a hole in the soil up to certain depth, placing the seed accurately in the same hole. The right amount of fertilizer will be spread over the seed. The process is controlled by a microcontroller.

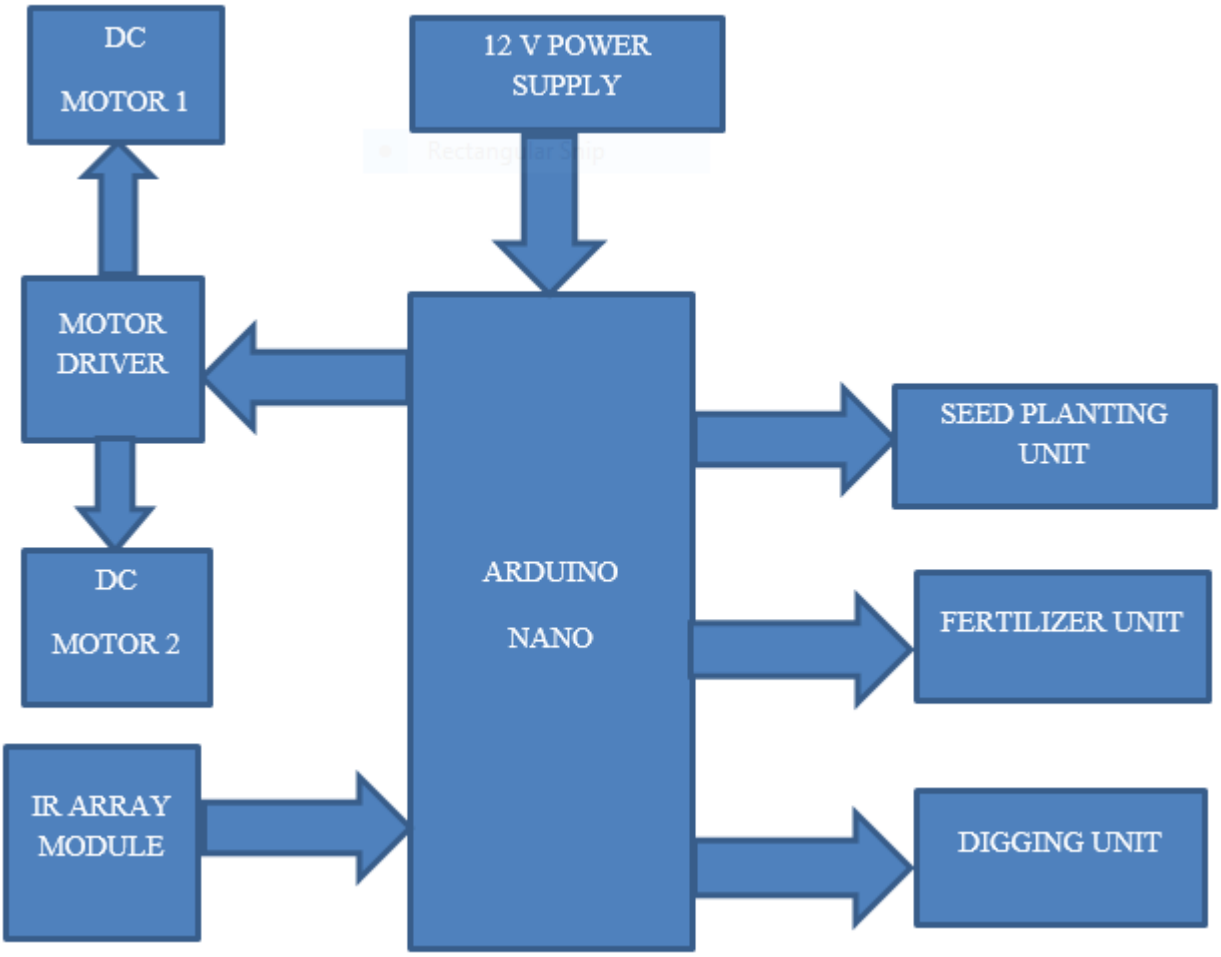

Fig 1. Block Diagram

A. Arduino Nano

Arduino Nano is the microcontroller used in this project. Arduino Nano is a small, compatible, flexible and breadboard friendly Microcontroller board, developed by Arduino.cc in Italy, based on ATmega328p (Arduino Nano V3.x) / Atmega168 (Arduino Nano V3.x).The data from the sensors (IR Sensors) will be given to Arduino and it gives corresponding signals to the Motor Driver IC.

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Fig 2. Arduino Nano

The Arduino Nano can be powered by means of the Mini-B USB, 6-20V unregulated external power supply, or 5V regulated external power supply. The power source is automatically chosen to the highest voltage source.

B. Motor Driver (L293D)

Fig 3. Motor Driver IC

L293D is a typical Motor driver or Motor Driver IC used in this project which allows DC motor to drive on either direction. L293D is a dual H-bridge 16-pin IC which can control a set of two DC motors simultaneously in any direction. Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. In this system, it receives signals from Arduino based on the information from the IR Sensors. The power supply to the motors must be given from the motor driver IC.

C. DC Motor

We have used two geared motors at the rear of the line follower robot. A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. These motors provide more torque than normal motors and can be used for carrying some load as well.

Fig 4. DC motor

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D. IR Sensor Array Module

Fig5 IR Sensor

This sensor module has 8 IR LED/phototransistor pairs mounted on a 0.375" pitch, making it a great detector for a line-following robot. Pairs of LEDs are arranged in series to halve current consumption, and a MOSFET allows the LEDs to be turned off for additional sensing or power-savingoptions.Each sensor provides a separate digital I/O-measurable output. The IR Rx emits IR radiation and the Rx helps in receiving the waves. A line follower robot, or a LFR in short, is a simple autonomous robot that optically tracks a line made on the surface of the floor. That means you have an arbitrary line drawn on the floor and the robot tracks it by moving right along it! The line is sensed using a piece of hardware called a line sensor.

E. Servo Motor

A servo motor is an electrical device which can push or rotate an object with great precision. It is just made up of simple motor which run through servo mechanism. All motors have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU. Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns.

Fig 6. Servo Motor

3.2.6. Power Supply

A 12v dc battery is being used for our autonomous robot used for driving the dc motors. 5volt supply is being used by the controller. A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells.

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Fig7. Power supply

III. METHODOLOGY

The fabricated robot is capable of performing the seeding and fertilising operation. The process involved in the operation/working of the robot can be divided into three categories, first one is the drilling process second one is the seed planting process and third one is the fertilising process. In this project we are using line following robot mechanism. A line follower robot, or a LFR in short, is a simple autonomous robot that opticallytracks a line made on the surface of the floor. That means you have an arbitrary line drawn on the floor and the robottracks it. At the first stage we should fill the seeds and fertilizer inside the two containers. When the power supply isgiven to the robot,its start to move in the field. When the robot detects the black line using IR sensor array module, it stops and makes a hole at certain depth using the mechanism made with a servo motor and a pointer. Then the seeds are dispensed in to the dig using the funnel arrangement setup in the metallic robot chassis. Then the robot starts moving forward and the repeats the same procedure when it detects the black line. In the next rotation, when the robot reaches the same location where the seeds are dispensed, it again stops and the right amount of fertilizer is dropped into the dig with the help of a servo motor and funnel. The procedure continues until the user stops the robot.

IV. FUTURE SCOPE

Apart from seeding and fertilization, fruit picking, harvesting, weeding, monitoring etc. can also be implemented to this robot. The controlling of the robot can be made via mobile by using Bluetooth or WiFi module.By making use of GPS technology seed mapping can be done.

V. RESULT

We developed a line following robot. A line follower robot, or a LFR in short, is a simple autonomous robot that optically tracks a line made on the surface of the floor. That means arbitrary line drawn on the floor and the robot tracks it..The right amount of fertilizer will be spread over the seed. When the robot starts moving in the forward motion, after few distance it stops and then it starts drilling with the help of a drilling mechanism. After this process, there is a funnel arrangement through which the seeds are being dispensed into the soil. Then the second rotation, the fertilizer is spread over the seed. This procedure continues until the user switches off the circuit. The robot that is developed is capable of making a hole in the soil up to certain depth, placing the seed accurately in the same hole.

VI. CONCLUSION

Automation is needed for industry, bio-medical, survey line etc..., especially in agriculture field for increasing yield of crops. Flexibility of automation system is higher than traditional system. This project is mainly based on minimizing man power as well as cost of the equipment. We have developed an Agricultural Automation Robot using Arduino. The advantage of this system is that it reduces the labour cost and time. In this work a robot is built and established to carry out automatic seeding and fertilization in an agriculture field. The project presents a low cost, low power, and simple system for device control. It is expected that the robot will support the farmers in improving the efficiency of operations in their farms. It can help the farmers in the initial stage of agriculture.

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