Implementation of Agriculture Based Bluetooth Controlled Robot

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Abstract

The idea of applying robotic technology in agriculture is very innovative, the opportunities for robot enhanced productivity is vast. Our prototype agriculture robot performs agriculture operations like seed sowing, ploughing and water spraying. Here we are using a regulated DC power supply (12V) to power the Arduino and DC motors which are connected to the wheels of the robot also with the help of Bluetooth; we will connect all the instructions through our mobile phone. We believe that this low cost and portable multipurpose robot will help the farmers and reduce their labor costs.

Keywords: *Arduino, Bluetooth, Motor Driver, DC Motor, Agriculture Robot.*

I. INTRODUCTION

During the last few years, agricultural segment has witness a wide implementation of revolutionary technology not only to improve the quality and quantity of the crops but also to simplify the labor load. These technology focuses on new and innovative agricultural solutions that have opened new limits for farmers. Robotic and automation technologies are now assisting farmers in various ways.

This work aims to develop and design of the robot which can plough the field, sow the seeds and cover seeds with the soil and also the irrigation purposes all the operations at single time. We will use a 12V DC Adapter to power the both Arduino and the motors. The plough and the mud leveling equipment are attached to the mechanical frame. While the 4 DC motors are used to operate the wheels of the robot. A 5V DC submersible pump is used to pump the water from water tank to the roots of the crop. A separate 12V dc motor is used for the seed sowing function. With the help of Bluetooth we will give all the commands to the robot through our mobile phones. In this project we will make the robot share its electrical and mechanical power in efficient way.

The organization of this paper is as follows. Section II deals with literature survey which presentspreviously published research paper's and related works. Section III shows the construction of the model being designed for the project.

The schematics of electrical connection diagram of multipurpose agricultural robot are presented in Section IV. The working principle of the whole model is discussed in section V. In section VI the steps of algorithm for the working of model is given and in section VII the results obtained after testing are provided. Future scope of the model is presented in section VIII while the conclusion of this paper is in section IX. Lastly the references of this paper are organized in section X.

II. LITERATURE REVIEW

Following are some of the research papers which helped us to understand the different aspects highlighted by the research on the agricultural robot. Robot's basic terminology, its function and use, all the process were written and experimented in this research paper.

In [1] K DurgaSowjanya, R Sindhu, M Parijatham, K Srikanth, P Bhargav discuses on the look, design and model of the autonomous agriculture robot. The main motive is to decrease the labor force and provide efficient way for it. It implements the use of Microcontroller and Bluetooth technology and helps in digging the soil, seeding, leveling the soil and then water spraying over the soil. The paper highlights how the robot can be controlled using just a simple Android app

and also helps in analyzing the parameters required for the model. The advantages of such simple model are that it is compact, lightweight and economic for the farmers also.

In [2] AkhilaGollakota and M. B. Srinivas have termed the indigenous agriculture robot as "Agribot". India is a major agriculture boosted economic country and so such machines are necessary for the farmers to work faster in the fields. The model consists of a PSoC controller to operate the components of the motor and it performs the functions like ploughing the soil, seedling and covering the soil over. The paper shows how PSoC controller can display over many parameters. The advantage of this model is that it willimprove the accuracy and efficiency of operations in the farms.

In [3] SaurabhUmarkar and Anil Karwankar underline the effect of unavailability of skilled workers in the farming occupation and use of machinery is very vast. So it presents a design and development of a robot which will perform the functions of ploughing, seed sowing and also to detect obstacles in the way. The result of this model shows how the seeds are placed in the field at different intervals. The advantage of such model is that it increases productivity in the farm and also operates on a renewable energy source of solar power.

III. CONSTRUCTION

Mechanical frame (chassis) of this prototype robot is made up of iron. All the mechanical and electrical components are mounted on this mechanical frame. On the front side of this frame the arrow shaped plough is welded. One can also fix this with nut and bolt so that user can easily remove it after the operation. On the back side of this frame mud leveling equipment is welded. In the middle, the funnel for seed storage and seed sowing mechanism is fixed. The shaft of this seeding mechanism is connected to the DC motor through relay. A water storage tank is placed over the components box and small submersible DC pump is used to spray water over the levelled soil through pipe. The chassis of this robot is fixed to four wheels and the movement of these wheels is controlled using DC motors. [2]

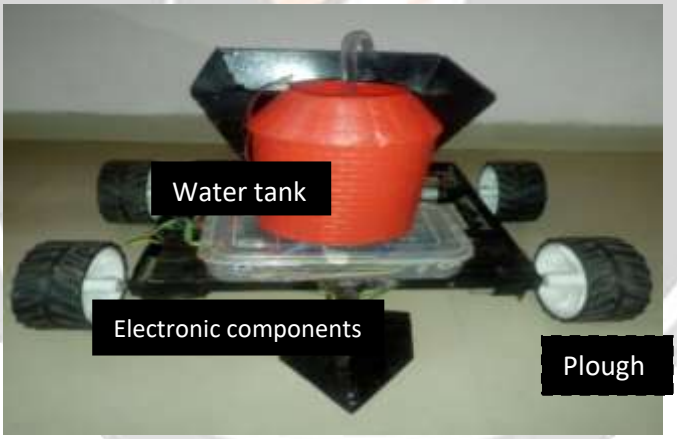

Fig. 1: Front side of Model

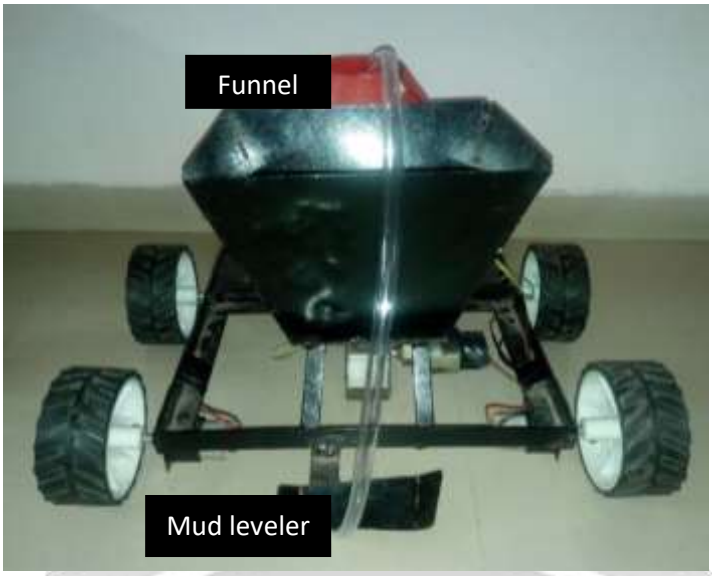

Fig. 2: Back/Rear side of Model

IV. ELECTRICAL CONNECTIONS

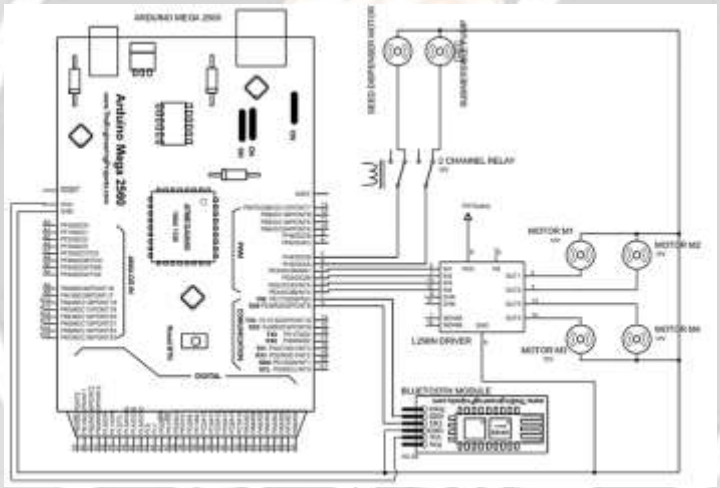

Fig. 3: Schematic Diagram of Electrical Connection

A. Interfacing of DC motor to Arduino Mega2560:

DC motor used in this prototype model operates on 12 V and 0.3A load current. Arduino mega2560 operates on 7-12V and approximately 50mA input current. Therefore we cannot connect DC motor directly to the Arduino. Due to this reason motor driver circuit is implemented. Function of a motor driver circuit is to take a low-current control signal and turn it into a higher-current control signal that can drive a motor. One motor driver circuit can control 2 DC motors with speed control while it can be used to control 4 DC motor without speed control.In this prototype model 1 motor driver circuit is used for controlling 4 DC motors, pair of 2 connected in parallel. These 4 motors are controlling the wheels of the robot.

B. Interfacing of pump to Arduino:

For irrigation purpose a 5V submersible pump is used. This pump is operated through a single channel relay. The relay acts as a switch and turns the pump ON and OFF. The relay requires a +5V supply from the Arduino and apart from this it also requires a digital signal from any digital pin of Arduino.

C. Seeding mechanism:

For seeding operation a dispenser is used which is operated by a 12V DC motor. This motor is connected to the Arduino through single channel relay. The relay acts as a switch and turns the motor ON and OFF. The relay requires a +5V supply from the Arduino and apart from this it also requires a digital signal from any digital pin of Arduino.

D. Bluetooth Module HC-05:

The Bluetooth module is connected to the Arduino with the help of Tx and Rx pins of the Arduino. These are the important pins for serial communication. The module is used so that the robot can be controlled via Android smartphone application.

E. Bluetooth Electronics Application:

This application is developed by KeuwlSoft Company. It is highly customizable and has numerous buttons and icons for the same.

Fig. 4: Bluetooth Electronics Application Panel

V. WORKING PRINCIPLE

The various operations of this prototype model are demonstrated below:

- **Ploughing function:**

The key purpose of ploughing is to turn over the upper layer of the soil, bringing fresh nutrients to the surface, while burying weeds and the remains of previous crops. A small arrow shaped iron piece plunger is welded in front of the model. As the model will move forward the plunger will dig the soil and turnover the bottom layer of soil in a straight line.

- **Seed sowing function:**

Seeding function is sowing the seeds in specific intervals in the dug soil. In this prototype model a seed sowing mechanism is used to dispense the seed in the soil. It consists of a storage funnel at the top where the seeds will be stored and a dispenser is attached at the bottom of it. The dispenser has a DC motor and a turbine attached to it. The turbine will rotate in a slow manner and with the help of its blades only few seeds will be dispensed in the soil after particular time interval for farming.

- **Mud closing and leveling function:**

Leveling means give a flat and even surface to the field and close the seed with the soil. In the prototype model, an iron sheet is welded at the back of the model for leveling. The mud is closed in the sowed soil and leveled accordingly.

- **Irrigation function:**

Irrigation is the method in which an adequate amount of water is supplied when the mud leveling equipment closes the seed with soil. In this prototype model, water storage tank is use to store water and a single channel relay is used which is connected to a submersible water pump to spray the water in the field.

VI. IMPLEMENTATION OF ALGORITHM

Step 1: Start

Step 2: Pairing Bluetooth model with mobile phone.

Step 3: If Bluetooth module gives 'W' signal, move the robot forward.

Step 4: If Bluetooth module gives 'X' signal, move the robot backward.

Step 5: If Bluetooth module gives 'A' signal, turn the robot in left direction.

Step 6: If Bluetooth module gives 'D' signal, turn the robot in right direction.

Step 7: If Bluetooth module gives 'S' signal, stop the movement of robot.

Step 8: If Bluetooth module gives 'a' signal, turn ON the water pump of robot.

Step 9: If Bluetooth module gives 'b' signal, turn OFF the water pump of robot.

Step 10: If Bluetooth module gives 'c' signal, turn ON the seeding mechanism of robot.

Step 11: If Bluetooth module gives 'd' signal, turn OFF the seeding mechanism of robot.

VII. RESULTS

- The model is working as per the design and every process is done in a similar manner.
- The robot ploughs the field, sow seeds, level the soil afterwards and disperses water over the soil.
- We expect that it will improves the efficiency and accuracy in the fields.
- Similarly we hope that all the process occur over a movement in single direction.

VIII. FUTURE SCOPE

1. As too much of sensors and things can make the system bulky and heavy, with further studies the model can be made lighter in weight.
2. Due to unbalanced level of field, the robot may find difficulty to operate straight for which the model can be made adjustable based on springs and level controller in future.
3. For longer ranges Wi-Fi DMPT technique can also be used.
4. In upcoming future the robot can be made fully automatic i.e. the robot will not require any operator.
5. Grass cutter and fertilizer sprayer can be added in future.

IX. CONCLUSION

- Multipurpose agricultural robot has successfully implemented and tested for various functions like ploughing, seed sowing, mud leveling and water spraying. It was developed by integrating agricultural robot with C programming.
- The benefits of such robots are that theycan improve the accuracy and precision on a great extent. Also these are also economical as the cost of such robots is very less.
- It is expected that this robot will help the farmers to improve the efficiency and accuracy of agricultural operations.

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