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Automated Multi-Tasking Agricultural Robot

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ABSTRACT: The robotic systems play an immense role in all sections of societies, organization and industrial units. The basic idea in this study is to develop a mechanized device that helps in on-farm operations like seeding/seed sowing at pre-designated distances and depths. This system has two main sections, monitoring station and control station, which are inter-communicated using/aided by the wireless Wi-Fi communication technologies. The control station as well as robotic station possesses the amenities which is soil moisture sensor, seed dispenser, and seed storage, robotic system with motors, Arduino microcontroller, and power supply. The Arduino uno is brain of this system, which can dedicate the order of suggestions received to all the networks, and sensible factors processed by their corresponding embedded programs. Robotic mechanism plays by their internal motors and motor drivers that drive the motors in desired directions. The Wi-Fi wireless protocol used for signal transmitting and receiving functions.

Index Terms – H Bridge, DC Motor, Arduino, Wi-Fi Module

I. INTRODUCTION

In India generally, the traditional seed sowing methods includes the use of animal drawn funnel and pipes driller or drilling using tractor. Earlier method requires labor, time and energy consuming. Whereas in tractor-based drilling operators of such power units are exposed to high level of noise and vibration, which are detrimental to health and work performance. The emphasis in the development of autonomous Field Robots is currently on speed, energy efficiency, sensors for guidance, guidance accuracy and enabling technologies such as wireless communication and GPS.

In olden days technology was not developed so seed sowing was done by hand. But now with latest robot technology, one can sit in a cool place and can do seeding by monitoring the robot motion. The main reason behind automation of farming processes are saving the time and energy required for performing repetitive farming tasks and increasing the productivity of yield by treating every crop individually using precision farming concept. Designing of such robots is modelled based on particular approach and certain considerations of agriculture environment in which it is going to work. These considerations and different approaches are discussed in this paper. Also, prototype of an autonomous agriculture robot is presented which is specifically designed for Ploughing, seed sowing, levelling and watering the crops.

Automation in seeding operation provides the accuracy in these spatial distance requirements of crops than traditional methods. Spatial requirement for each crop must be satisfied to have equal access of air, light, ground moisture, etc. Seed sowing in proposed system is as follows: digging the soil at a crop specific depth, dropping of seeds in the hole, covering it by soil and then pouring water on it.

II. PROPOSED MODEL FOR AGRICULTURE AUTOMATION

System requirements specification is to specify in detail the system components, both hardware and software, which are needed for the system implementation, along with operational requirements, as anticipated from the system.

The whole system of the robot works from the main AC power supply. The base frame consists of four wheels connected to four arms and the rear wheel is driven by dc motor. One end of the frame, cultivator is driven by DC motor which is made to dig the soil. The seed sowing mechanism can be achieved by rotation of the flap connected to DC motor in particular direction, so that the seeds stored in the funnel is dropped at a position where the digging happened. A leveler is made to close the seeds and water sprinkler is used for spraying water. Wi-Fi technology through smart phone is used to control the entire operation of robot for ploughing, seed sowing, levelling and water sprinkling.

The Heart of the proposed system is microcontroller, Wi-Fi module, DC motors relays are interfaced to the microcontroller to provide various operations like ploughing, seeding, leveling and water spraying. The entire mechanism of the system is controlled by Wi-Fi module from Android smart phone. The wireless communication of Wifi technology enables the robot to move in four directions as front, back, right and left. Various commands can be used to move robot into forward, reverse, stop, left, and right. The microcontroller in the proposed model enables various functions in the field according to the commands received from smart phone.

Agriculture robot can perform operations like automatic ploughing, seed sowing, levelling and water sprinkling. The quality development of project is for a system which minimizes the working cost and reduces the time for digging task and these entire tasks run by power supply.

III. BLOCK DIAGRAM AND FLOW CHART

The fig 1 shows the block diagram of Agriculture robot. It explains the operation of whole agricultural automation system.

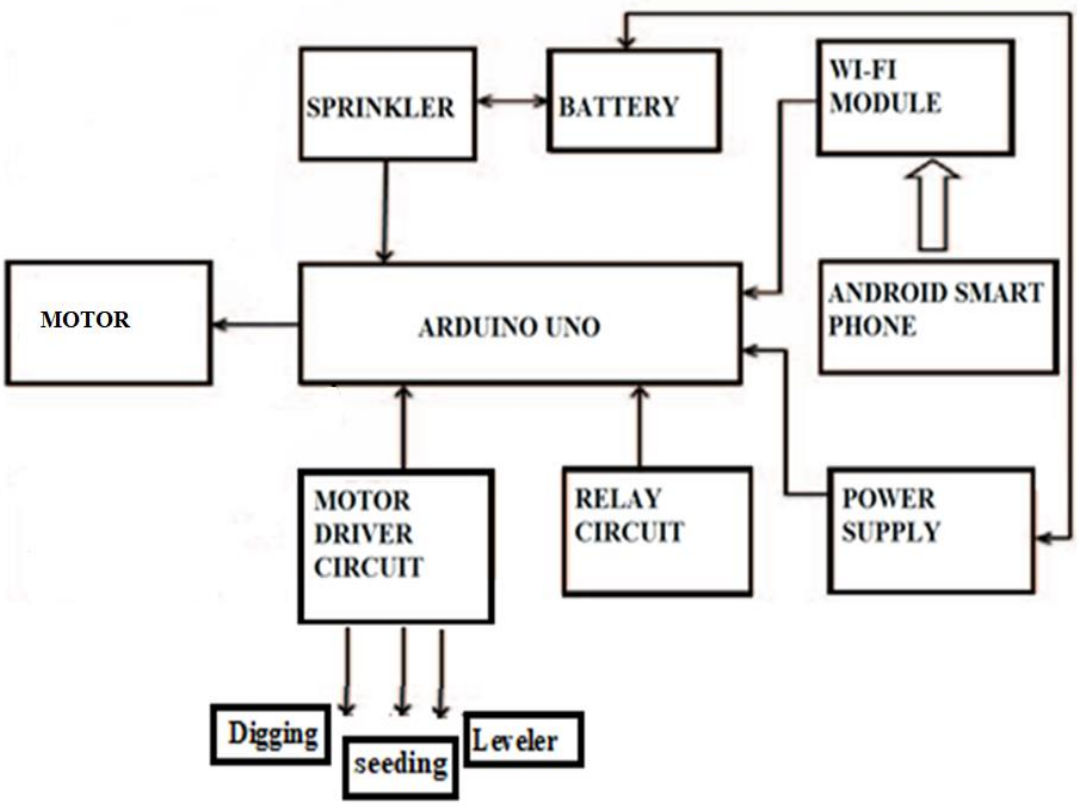

Fig 1: Block diagram of Agri-bot

The main reason behind automation of farming processes are saving the time and energy required for performing repetitive farming tasks and increasing the productivity of yield by treating every crop individually using precision farming concept. Designing of such robots is modeled based on particular approach and certain considerations of agriculture environment in which it is going to work. These considerations and different approaches are discussed in this paper. Also, prototype of an autonomous Agriculture Robot is presented which is specifically designed for Ploughing, seed sowing, leveling and water sprinkling. It is a four wheeled vehicle. Its working is based on the precision agriculture which enables efficient seed sowing at optimal depth and at optimal distances between crops and their rows, specific for each crop type.

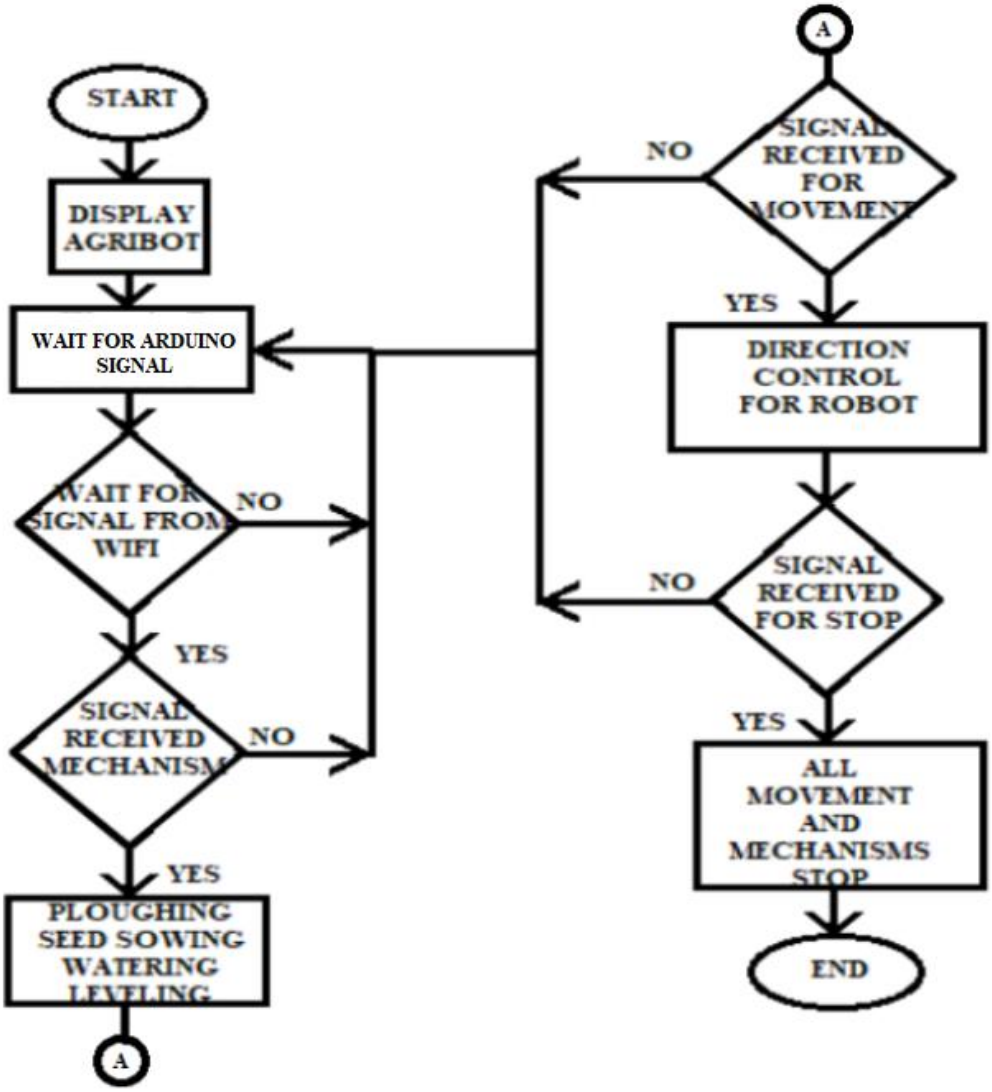

Fig 2 Flow Chart

IV. METHODOLOGY

Mode 1: Ploughing

The ploughs are connected to motor and placed on the front side of the robot. Ploughs are made up of steel to perform digging with the plough shaft length of 10cm and plough share of 4cm with the thickness of 0.3mm. The ploughs are made to plough 3 times to ensure efficient ploughing method.

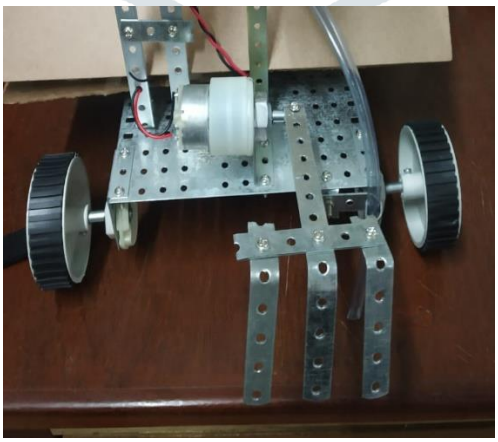

Fig 3: Ploughing

Table 1: The placement of seeding

Placement of seed (distance between two seed)	Farm land
Corn Expected (6-8 cm)	7.2cm
Wheat Expected (8-10 cm)	9 cm
Jowar Expected (10-12 cm)	10cm
Soya bean Expected (5-6 cm)	1.2 cm

Mode 2: Seed Sowing

Seed sowing mechanism consist of DC motor and a funnel. Where seeds are filled in a funnel which is placed above the DC motor. Initially the seeds from the funnel are blocked by the flap which is connected to the DC motor. The seed sowing mechanism can be achieved by rotation of the flap connected to DC motor in a particular direction.

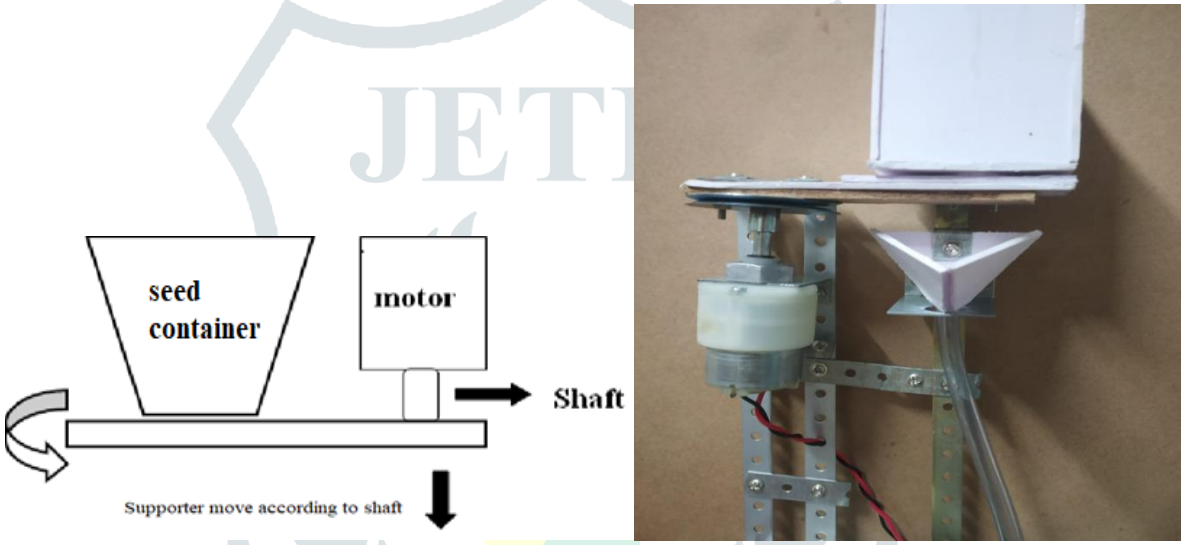

Fig 4: Seed Sowing

Mode 3: Leveler

Leveller is placed at front of the robot. This will help to make an uneven surface to a flat shape. When robot starts moving forward, the even surface has up's and down's leveler will make all the area to flat surface.

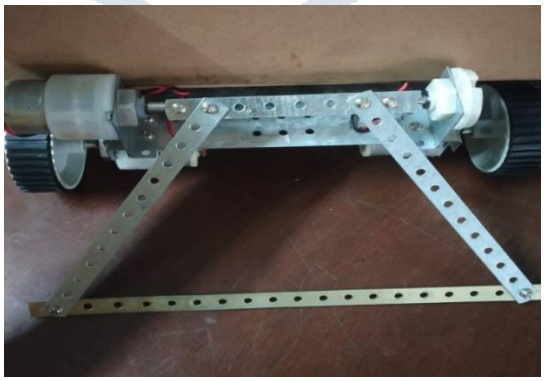

Fig 5: Levelling

Mode 4: Water Sprinkler

This is lightweight, small size, high efficiency, low consumption and low noise water pump .A water pump is an essential tool to pump out water from the tank. It controls the speed of the water. The pumps come with various design and capacities to cater the different needs of water pumping.

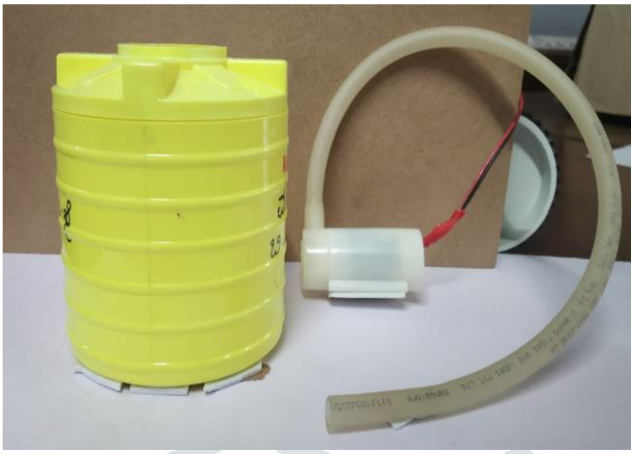

Fig 6: Submersible pump

V. RESULT & DISCUSSION

The agricultural robot will be using a chassis as a base to connect and assemble everything on it will be consisting of four motors. Two of which are toy motors and the other being gear motors. The robot is capable of doing four separate functions.

1. Ploughing
2. Seed sowing
3. Levelling
4. Water sprinkling

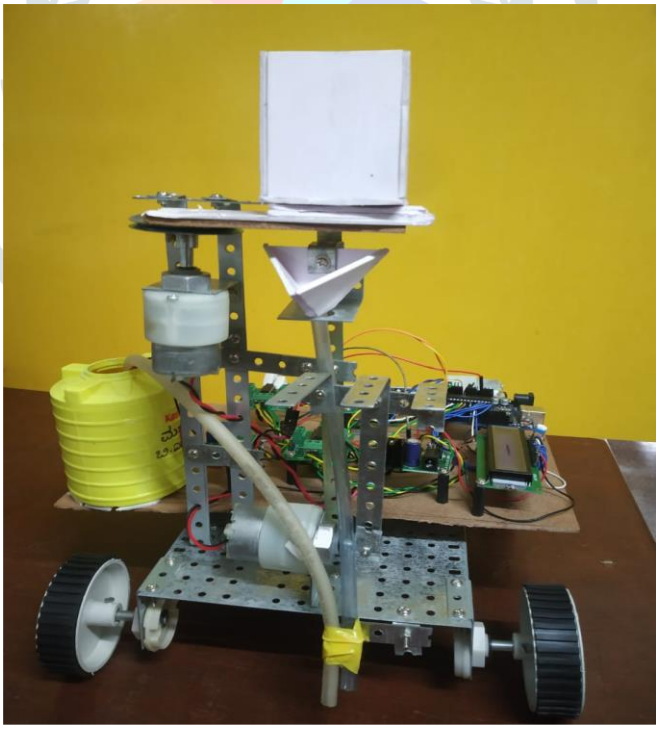

Fig 7: Front view of Agribot Model

FUTURE SCOPE

1. Automated disease prediction
2. Intimation to farmer
3. Water sprinkling based on moisture levels
4. Pesticides sprinkling automation
5. The robot can be designed with chain roller instead of normal wheel.

VI. CONCLUSION

An attempt has been made to develop a Bluetooth operated agricultural robot which performs ploughing, seed sowing, mud leveling and water sprinkler operations. The proposed system is battery operated and controlled by Wifi module. Using this robot, farmer can carry out other secondary activity along with operating the robot. By carrying out multiple activities at the same time, farmer can increase his income which results in development of Indian economy.

It reduces manual labor requirement which is a boon to the farmers as finding laborers is a very difficult job today. The time required to carry out the five functionalities reduces considerably in comparison with carrying out the same activities manually.

This robot is controlled by using algorithm for the comfort of farmers and interfaced by using arduino board. It is expected that this robot will change the trend of farming in the upcoming days from manual to automate. The implementation of Agricultural robot has significant saving in the term of time, efficiency, man power, wastage of resources and also it works at much cheaper price.

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