

A Multipurpose Agricultural Robot for Automatic Ploughing , Seeding and Plant Health Monitoring

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Abstract—This approach is on the designing of agricultural robot for various tasks. Certainly robots are playing an important role in the field of agriculture for farming process autonomously. In agriculture, the opportunity for robot is enhancing the productivity and the robots are appearing in the field in large number. The proposed system focuses on implementing all the farming process especially in the field of ploughing and seeding by using microcontroller, HC-05 and HC-06 Bluetooth models, various sensors etc.,. The robot detects the planning area by using sensors and seeds need to be planted in the corresponding field using gripper arrangement of the robot. In a continuation, the rest of remaining process could be done automatically. In recent years the development of the autonomous vehicles in the agriculture has experienced more interest. This robot will help the farmers in doing the farming process more accurate.

agricultural purposes like ploughing, sowing and mud leveling. The robot can operate in any weather conditions. The agricultural robot mainly tests the soil using soil moisture sensor, in addition to this the temperature and humidity sensors also been used. The sensory data's are displayed on LCD display. As the robot is controlled by using Bluetooth the individual operations can be performed separately.

I. INTRODUCTION

Indian economy is based on agriculture. The backbone for food production are farmers. Traditionally farming is done by human being with the help of bullock carts, tractors and tillers etc. In modern era, the main problem in agricultural field include lack of labor availability, lack of knowledge regarding soil testing, increase in labor wages, wastage of seeds and more wastage in water. To overcome all these disadvantages the robot for agriculture has been developed. The main aim of agricultural robot is applying robotic technology in agricultural field. The agriculture robot efficiently performs ploughing, seeding and mud leveling automatically. The robot is a mechanical device which is capable of performing various tasks without human intervention. The robot works based on command given by the controller. Various sensors are used for sensing various parameters along the robotic path. The microcontroller being the heart of the robotic system manipulates entire the action of the robotic system. It also controls a wheel motion by controlling the DC motors. Motor driving circuit is used to drive the DC motor which in turn controls the wheel motion.

Controlling of the robot mainly require some means of communication. One of the communication means is the wireless Bluetooth connectivity. HC-05 and HC-06 are the Bluetooth modules that are used to control the robot using Smartphone. The Bluetooth application is user friendly and data exchanging between robot and smartphones is done systematically. The developed robot is focused on



Figure 1: Example of agricultural robot

II. MOTIVATION OF THE PROJECT

The agriculture has always been the backbone of India's sustained growth. As the population of India continues to grow, the demand for production will also grows. Hence, there is a great need for multiple cropping in the farms and this in turn requires efficient and time saving machines. The paper discusses the modern way agriculture which will be helpful for the agriculture industry to move towards mechanization.

III. PROBLEM STATEMENT

Agriculture is a very important sector in Indian economy. Most of the livelihood in India depends on agriculture. As

the knowledge based farmlabours are less, the requirement for them is high and their wages are increasing. Traditionally farming is done by human being with the help of bullock carts, tractors and tillers etc. The main problem in agricultural field include lack of labor availability, lack of knowledge regarding soil testing, increase in labor wages, wastage of seeds and more wastage in water. The idea of applying robotics technology in the field of agriculture is very new. In agriculture, the opportunity for robot-enhanced productivity is more and the robots are appearing on farms in various guises and in increasing numbers.



Figure 2: Manually working in field

IV. PROBLEM SOLUTION

In recent years there are many agricultural robots which can perform only single or dual tasks. We are improving the robot by designing a agricultural robot for spraying water, seeding, mulching and cutting operation. More than 42% of the total population in the world has chosen agriculture as their primary occupation. In recent years, the development of autonomous vehicles in agriculture rational and adaptable vehicles. In the field of agricultural autonomous vehicles, a concept is being developed to investigate if multiple small autonomous machines are more efficient than traditional large tractors and human force. These vehicles should be capable of working round the clock all year round, in most weather conditions and have the intelligence embedded within them to behave sensibly in a semi-natural environment over long periods of time, unattended, while carrying out the useful task. There are a number of field operations that can be executed by autonomous vehicles, giving more benefits than conventional machines.



Figure 3: Modernized technology

V. EXISTING SYSTEM VS PROPOSED SYSTEM

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VI. OBJECTIVES

- To build a battery operated smart agricultural robot for multipurpose farm activities.
- It should check the moisture content in soil, humidity of surroundings and temperature of seed.
- The ground should be dug to the specified depth and the adequate amount of seeds has to be dispensed then it should level the mud after seeding operation.
- It should be easy to operate and safe handling.

VII. LITERATURE SURVEY

The development of our agricultural robot and the idea used to implement them, started with the study of various papers.

Designing, employing, and examining an autonomous multipurpose vehicle[1] with safe, reliable and

economic operation. This autonomous vehicle goes through the crop lines of Agricultural land and performs duties that are tiresome and/or unsafe to the farmers. First, it's been prepared for spraying, but other configurations are also designed, such as: a seeding, plug system to reach the most notable area of the plants to execute different tasks (pruning, harvesting, etc.), and a truck to move the fruits, crops and crop waste products. The wheels of this robot are designed so that it can travel easily in soft and wet soil.

An automatic robot for agricultural purposes[2]. As one of the styles of development on automation and cleverness of agricultural equipment in the 21st century, all types of agricultural robots have been explored and developed to apply lots of agricultural development in many countries. This bot carries out primary functions like picking, harvesting, weeding, pruning, planting, grafting. They developed a robot to perform various activities in farm like cutting and picking. Image processing is used to identify grass in the field and also the height of the crop. A container is used to place the cut grass and harvested crops. Pesticide spraying is also equipped in the robot.

Improvement in agriculture techniques like automatic planting of seed products on ploughed land by using automatic robot[3]. A robotic vehicle having four tires and steered by DC motors was developed. The seed planting device is fixed on the automobile to seed the seed products in even manner. The device will cultivate the plantation by considering particular rows and specific column at predetermined distance depending on different seed products. The obstacle recognition is considered and sensed by an infrared sensor. The complete assemblage is driven by a 12V rechargeable battery pack. The battery pack can be recharged by using solar power which is also attached to robot. This robot can perform bed preparation, seed mapping, seed placement and reseeded operations.

The design, development and the fabrication of the automatic robot [4] which can dig the ground, put the seed products, leveller to close the soil and sprayer to apply water, these complete systems of the automatic robot works together with the power supply and the solar powered energy. Steering operation of robot is done using rack and pinion mechanism. Relay switch regulates power input for motor. Obstacle detection is done using IR sensor. A lot more than 40% of the populace on earth selects agriculture as the principal occupation; lately the introduction of the autonomous vehicles in the agriculture has experienced increased interest.

An automatic robot [5] capable of carrying out procedures like programmed seeding, irrigation, and fertilization. In addition, it provides manual as well as auto control. The primary component is ARDUINO that supervises the complete process. Currently, robots are significantly being built-into working tasks to displace humans especially to execute repetitive job. Seeding is main steps in farming. In this process seeding is carried out in every row of the farming plot. In irrigation process, the soil sensor is used for monitoring environmental condition. It checks this level and alerts the farmer, then gradually applies little bit of water to the planted seed in every rows of the farming plot. The fertilization process is identical to

irrigation process however, many plants need fertilizers when the seed germinates and the seed starts to develop. The automatic robot works on solar technology.

An automatic robot which targets employing all the farming process especially on onion crop [6] within a bot by using firebird V automatic robot. The fire bird V robot uses ATMEGA 2560 as master controller, ATMEGA 8 as slave controller, IR, gripper design and other accessories. The suggested system prototype is applied by selecting an area which taking into consideration the agricultural field of any sort of onion crop. The automatic robot picks up the planting area by using detectors and seed products to be planted in the related field using gripper set up of the automatic robot.

VIII.METHODOLOGY

The methodological procedure, circuit diagram and the block diagram are included in this section. The development of the agricultural robot consists of the integration of hardware techniques and software tools. Fig. 4 shows the blockdiagram of agricultural robot.

Arduino Uno microcontroller is the master controller of the developed robot. All the operations of the robot are controlled through Bluetooth connectivity.The robot for agricultural purpose is an autonomous robot which is controlled remotely through a wireless Bluetooth connectivity between the Smartphone and the robot. The Bluetooth electronics app is used to control each and every operation of the robot. The Bluetooth HC-05 module is fixed on to the robot which receives signals from the Bluetooth electronics app and sends these signals to the microcontroller forprocessing of operations.

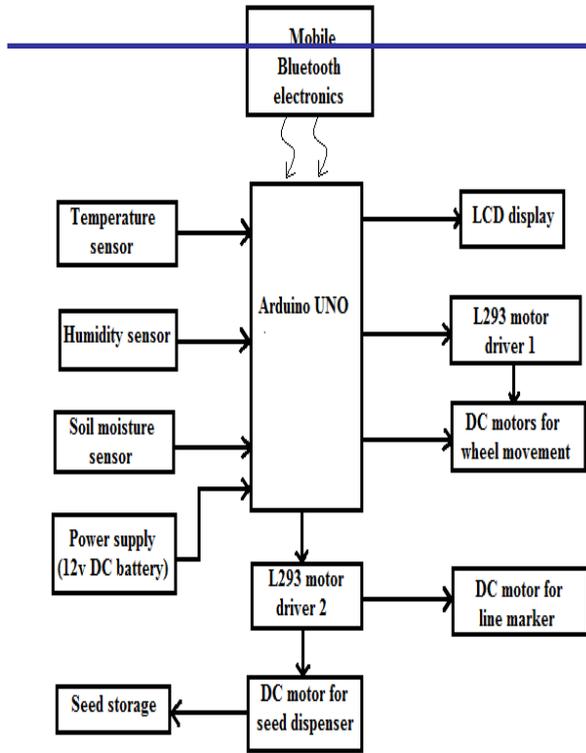
The microcontroller is powered by a 12V DC battery and it consists of a voltage regulator, which is used to regulate the voltage input for the controller.The microcontroller gives a 5V supply to the driver circuit. This supply is insufficient to actuate DC motors. Thus driver circuit amplifies 5V current into 12V current and drives the motors connected to it.

The L293D motor driver 1 circuit is used to control the bidirectional motion and receives signals from the microcontroller.The DC motors control wheel motion and other activities of the robot. The microcontroller sends signals like 00,01,10,11. When signals are like 00 or 11 then the motor is in off condition so there is no movement of robot occur, if else the signal like 01 then the motor will rotate on backward direction else the motor rotate on forward direction(when signal is 10).

Figure 4: Block diagram of our model

The L293D motor driver 2 circuit which controls two Dc motors. One DC motor is used for line marker and another one is used for seed dispenser. A line marker is used to mark a line along which seeds are dispensed. The marker has a single teeth and only one line is marked along the path of the robot. The depth through which the mark is done can be controlled through the Smartphone.

The seed storage device is a cone like structure or a hopper in which seeds are stored for seeding purpose. The



hopper has a tube extension in its lower part and this hopper tube will allow seed to flow to the lower part of the robot i.e., for seeding position. Seeds from the hopper are dispensed for seeding through a seed dispenser. The seed dispenser assembly consists of a motor and a tube with a hole through it and is attached to the shaft of the motor. The dispenser tube is horizontally aligned inside the hopper tube. As the motor rotates the hole in the tube displaces. When the axis of the hole comes in contact with the axis of the hopper tube, a seed is dispensed. As the motor continues to rotate, the axis of the hole is displaced from the axis of the hopper tube. Therefore there is no seed dispensing. After the seeding operation, a leveler is used to close the soil and to level it.

Three types of sensors are used in the robot; they are temperature sensor, humidity sensor and a soil moisture sensor. Temperature sensor is used to measure seed temperature. The humidity sensor measures the humidity content of air. The soil moisture sensors will measure moisture quantity in the soil and conditions of soil i.e., either wet or dry. The output signals from these sensors are displayed on the LCD screen.

IX.ADVANTAGES

- With the help of innovative seed sowing equipment the seed can feed into the soil continuously without any restriction while in flowing of seed.
- Most of seed sowing equipments machines mentioned require only one person to operate. Hence it reduces labour cost.
- Overall Cost for seed sowing process will be reduced by using this seed sowing equipments.

- These equipments can also be used for sowing different types of seeds. It is helpful for small and medium scale farmers.

X.APPLICATIONS

Seed sowing devices plays a wide role in Agriculture field.

XI.CONCLUSION

An attempt has been made to develop a Bluetooth operated agricultural robot which performs ploughing, seed sowing and mud levelling operations. The proposed system is battery operated and controlled by Bluetooth device. 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.

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