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Implementation of AGRIBOT to Perform the Elementary Functions Involved in Farming

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***Abstract*—Agriculture is very important for Indian Economy. Almost 70% of the rural family's dependant on the agriculture. Nowadays, so many of farmers are not interested in farming, instead they search for better opportunities. The reason is agricultural problems like inadequacy of irrigation, robbery in storage field; seeds are wasted during seeding, less production and so on. Also need much more time to do every operation. The implemented system is a prototype of Agri Bot, multiple agricultural tasks can be done using the robot. This paper focuses on the work carried out by the ways of designing and developing a prototype of Agri Bot that can be helpful to overcome the problems currently faced by a farmer. In the implemented system, HC-06 Bluetooth module is interfaced with Arduino UNO to control the functionality of the robot. The implemented prototype of Agri Bot is used to do accomplish the tasks like land ploughing, cutting the weed, sowing the seeds and irrigation using diaphragm pump.**

***Index Terms*— Agricultural Robot (Agri-Bot), Arduino UNO, HC-06 Bluetooth module, Farming, Ploughing, Cutting the weed, Sowing the seeds and Irrigation.**

I. INTRODUCTION

Farming is the main foundation of India. Indian history in agriculture is drawn from Era of Indus Valley Civilization. Even also in some other parts of Southern India. Nowadays, India is second rank in the production of farming. In different fields such as industrial, military, medical applications etc., the special vehicles play a major role. In order to enlarge the farming productivity, the special vehicles are used in agricultural field. The common problems in Indian farming is increasing input costs, lack of good labors, less water resources and maintaining the crops. As a part of solution to these, automation techniques are used in farming. So the automation techniques in agriculture area could help farmers to decrease their efforts. The automated special vehicles are developed for the processes seed sowing, watering, ploughing and leveling land. All these tasks are cannot performed by a single vehicle. Also peoples are cannot do these multiple tasks at a time. In this research work, robots are established to do multiple tasks autonomously. The developed prototype can be used to perform the operations of seed sowing, ploughing land, watering and leveling. In a single vehicle these multiple tasks can be integrated and then performed.

In Agriculture robots are found that one of the vital key that is involved deeply in future farming industries. By 2050 approximately 10 billion global projected populations for agricultural consumption is expected to hire 70% more by reducing the work pressure in agriculture improving countries. This work is mainly focuses on the

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implementation of the agricultural robot (Agri-Bot) for low cost crop seeding and also to multiple tasks in a single vehicle. The intension behind this work is to decrease the human force, labor requirements and budget in the agriculture field. The developed prototype was arranged using easy, low cost and off-the self-components.
In this research work, the Agri Bot implemented is mainly contains two parts, one is a mobile base used for robot movement and second one is a seeding mechanism which is attached to the mobile base that is for the application of crop seeding. Four-wheel design is attached to the mobile base for the easy movement on uneven terrains. The Agri Bot operates on the basis of operator commands. This system can be operated autonomously and safely. This prototype reduces the cost compared to the methods used traditionally and also human risk will be decreased as robot will do all the tasks according to the command. In this work, it is estimated that the Agri Bot can improve the efficiency of the seed sowing process by up to three times compared to the manual seed sowing by laborers. Also in soil structure as opposed to heavy machinery, Agri Bot will not damage in an agriculture field. The aims of this work is to develop a low-cost, multiple task performing agricultural robot (Agri-Bot) for crop seeding, ploughing, water spraying and cutting the weed in the agricultural fields.

II. Literature Survey

Many works have been carried out in this direction so far. Few of the recent works are mentioned below - A multifunctional robot is designed to perform several agricultural tasks. Including the agricultural operations, robot also checks the pH value in soil, temperature, humidity, moisture content. For live streaming here camera is used but to control the seeding and fertilizing tasks, the solenoid is used, that helps the system to be more complex and for that more space is required [1]. Amrita Sneha's work aims to perform the process of ploughing automated and parallel seeding process using Advanced Virtual RISC (AVR). But the field outside is strictly operated functions manually [2]. The robot starts its operation by ploughing the area first and then seeds sowing with the ploughed area. Then process ends with covering the seeds which are sown in the soil. This reduces the risk of labor and farmers, also increases the task speed. Moreover, time is saved, but it has less accuracy and efficiency [3]. The system implemented in this robot is operated by human control. This manually guides the functionality of the robot through a desired path which is called teaching stage. The robot will navigate automatically with the taught information that is called as execution phase. It translates the demonstrated characteristics immediately into the executable code. But at any point of time the counter variable can overflow [4]. One more implemented system used the brain computer interface system. Here the system does not include the training for individual users. But it requires the excessive training for slow speed and also for the proper usage [5]. In this work, Swati D Sambare worked for the particular position to drop the seeds by considering specified distance between two seeds. But the drawback here has complex design for the individual performance [6]. Mark E Russell implemented a system called universal gripping mechanism. This possess the ability to pick unknown objects irrespective of its shape within the given size range. But the disadvantage is it increases the complexities on both hardware and software part for the small objects [7]. A collision avoidance variable speed technique is implemented by Lijina P Nippun based on the robots RSSI value. This value is mainly used to implement the obstacle avoidance. But the drawback is proximity sensors having limited operations [8]. Saurabh Umarkar introduced farming system which is powered by solar panel. This system is controlled by Android Applications. Here the disadvantage is solar panels are expensive [9]. T A Mohana Prakash implemented smart agricultural system. These smart robotic systems are made by using IoT technologies [10]. In agricultural field, while operating with vehicle like tractors, a RF remote control system was designed by Pirkala Athish Reddy. But this remote control system can be used only for shorter distance [11]. Dasarinaga Vinod designed a system which can move instinctively for agricultural robot. Involuntarily this system is used for ploughing in different depths which is mainly depending upon the soil, irrigation and seeding mechanisms in the agricultural field. The new system is equipped with the camera for agricultural robot. Through the Wi-Fi network, the system sends the data to the desktop [12].

III. Methodology

Agri Bot is equipped with Bluetooth which is interfaced with the Arduino to compute the directions and functions of the entire system. The Arduino is further connected to three L298N motor drivers. One L298N motor driver has two outputs. The first L298N motor driver outputs are used to operate the left and right DC gear motors and similarly second L298N motor driver outputs are used to operate ploughing and cutting gear motors whereas, the last motor driver outputs are used to operate diaphragm spray pump and seeding motor as illustrated in the figure1.

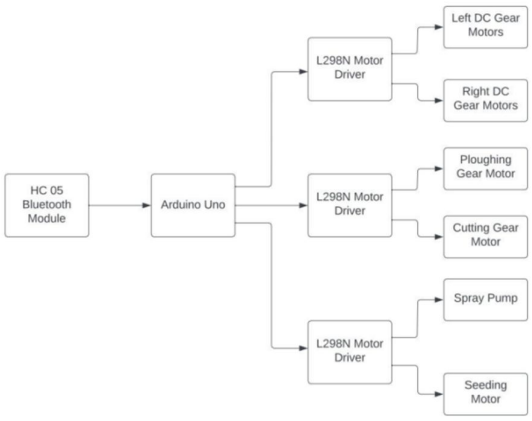

Figure1: Block diagram of Agribot

A. Robot driving mechanism

The robot driving mechanism model contains of 4 wheels. These four wheels are in turn connected to four DC motors respectively. The wheels are driven by L298N motor driver. Right motors and left motors are shorted respectively to the motor driver. For the robot movement like forward, reverse, left, right and stop direction by using various commands. Robot direction involves performing the various functions in the farming field according to the commands received by the farmer.

B. Ploughing mechanism

Before seeds sowing process, the upper layer of soil should be loosening or roll over. This method is known as ploughing. These clods then allow the organic nutrients for new cropping. In this Agri-Bot prototype model, ploughing operation will be done by using DC Motors. When the wheels which are started to rotate which are connected to the dc motors, then the arm cultivated is goes down and dug up the soil. The Bluetooth app controls the direction of the cultivator which is installed in the smart phone. For simple and fast mechanism, a trapezoidal or quadrilateral road is used which helps to move the ploughing arm in the direction of vertical.

C. Seed Sowing Mechanism

Seed sowing is a function of planting the seeds in a specific manner. Seed sowing process is actually followed by the ploughing function. A funnel can be used in the Agri-Bot prototype model for seed sowing operation. Seeds are stored in funnel and the shaft is connected to DC motor lower rpm. When the motor rotates by the shaft, the seeds are drift from the funnel. So seeds are dropped into the soil through a hole at the bottom with a short time delay as per the need of the user. The third L298N motor driver is responsible to carry out the seeding mechanism.

D. Water spraying mechanism

Water is drifted through the pipe from the container. The water pump will be used to spray the water or fertilizers. After seeds are sown, this mechanism is used for spraying water. After the crops are grown up for pesticide water spraying is used to avoid from get affect by pest. Thin copper misting nozzle is used to spray water or pesticides in all directions enhancing the irrigation system. The spraying mechanism is carried out by third L298N motor driver.

IV. RESULTS

The robot has to be operated using Bluetooth to perform agricultural tasks as per the need. The Agribot is operated with 7AH lead acid battery as the major power supply. The system has 4 wheels and a cutting blade at its anterior region, seeds for sowing in the funnel, water for spraying in the water tank and ploughing mechanism at its posterior end.

Figure2 shows the implemented system of “Agribot” which is capable of performing several agricultural tasks such as seeds sowing, water drifting, ploughing, cutting weeds and leveling. The robot has to be operated using Bluetooth to perform agricultural tasks as per the need. The Agribot is operated with 7AH lead acid battery as

Figure 2: Agri-Bot–performing multiple agricultural tasks

the major power supply. The system has 4 wheels and a cutting blade at its anterior region, seeds for sowing in the funnel, water for spraying in the water tank and ploughing mechanism at its posterior end.

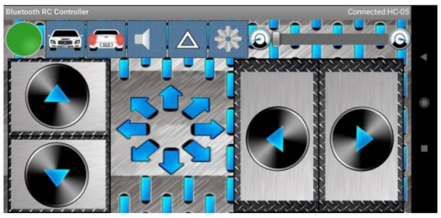

Figure 3: SmartphoneconnectedtoAgribotthroughHC-05Bluetoothmodule

The overview of the Bluetooth RC Car application is shown in figure3 which is used to control the robot. The green light in the top left corner indicates that the Bluetooth is connected successfully. The icon next to it represents cutting mechanism and the second icon represents the ploughing mechanism. Further the third icon represents the water spraying mechanism and next to it represents the seeding mechanism. The two up and down arrows in the left side are used for forward and backward and the two arrows on the right side is used for left and right movement of the robot.

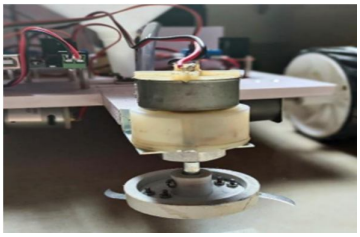

Figure 4: Cutter installed in Agribot

Figure4 shows the cutting blade installed in the anterior end of the Agribot to perform cutting mechanism. It helps in cutting unwanted weeds by spinning its blades with high speed.

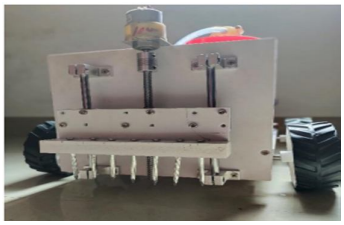

Figure 5: Ploughing tool

Figure5 shows ploughing tool in the posterior end. The ploughing tool is supported with two smooth rods on both the sides. When the motor started to rotates in clockwise direction, then the ploughing operation will start by moving in the downward direction. When the motor started to rotates in anticlockwise direction and then the ploughing tool will move in the direction of upward.

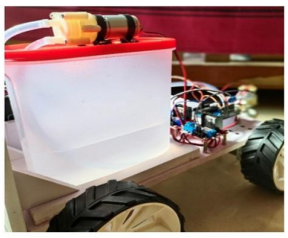

Figure 6: Water spraying tank.

Figure6 shows water spraying tank used for irrigation. A diaphragm pump is placed on the tank to operate the spraying mechanism.

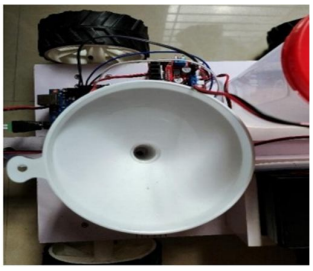

Figure 7: Seed sowing funnel

Figure7 shows the seed sowing funnel which is used to place the seeds for sowing. As the motor rotates the seeds fall in a pre-determined manner.

V. Conclusion and Future Scope

A prototype of Agribot has been implemented, designed and developed to demonstrate the agricultural tasks such as ploughing, sowing of seeds, pesticides/water spraying and cutting of weeds. This system can overcome the problems related to labor wages, improper dispersal of seeds and wastage of water due to extensive irrigation and loss of soil fertility due to improper usage of fertilizers. This agricultural robot named as "AGRIBOT" is used to perform multiple tasks in farming. This easily reduce the farmer's efforts, laborers work time and also the cost. Compared to conventional method of cultivation in farming, the robot machine reduces the overall time and requires less man power. This implemented Agribot system is a battery operated. And this prototype is mainly controlled by Bluetooth app device. Farmer can carry out extra secondary activities including robot operations. In agricultural field, several tasks have to be done at a time. So multiple tasks can be operated by using Agri-Bot system at the same time. This increases the farmer's income which in turn gets results in the development of Indian economy.

The quality of our lives can be improved by Robots and also it enhances the opportunities for human beings in future. This creates better life of farmers. The opportunities for robot-enhancement productivity are enormous and the robots are appearing on farming in different ways. The other problems associated with autonomous farm equipment can probably be overcome using Agribot. By the usage of small machines crop productivity may be done better and cheaper than with a few large ones.

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