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Multifunctional Agricultural Robot by Using Raspberry Pi 3B+

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ABSTRACT: Agriculture is one of our most important industry for providing food, feed and fuel necessary for our survival. Certainly, robot are playing an important role in the field of agriculture for farming process autonomously. The advent of robot in agricultural drastically increased the productivity and output of agricultural in several countries. Further, the uses of robot in agricultural reduces the operating costs and lead time of agriculture. Agribot is designed for agricultural purposes. It is designed to minimize the labor of farmers in addition to increasing the speed and accuracy of the work. Normally farming process includes planting, spreading of fertilizers, spraying of pesticides. This multipurpose system gives an advanced method to seed sowing,ploughing,waste grass cutting,spraying of pesticides and spreading of fertilizers with minimum man power and labour and making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific columnsat fixed distance depending on crop. At present time, agriculture robots must have human interaction in order to compensate for programming complexity issues.

KEYWORDS: Raspberry pi 3b+,Relay driver, Relay,PMDC Motor,Sensing camera.

I. INTRODUCTION

Agriculture is the backbone of India. The idea of applying robotics technology in agriculture is very new. In agriculture, the opportunities for robot-enhanced productivity are immense and the robots are appearing on farms in various guises and in increasing numbers. The robotics plays a major role in various fields such as industrial medical, military applications etc. The application of instrumental robotics are spreading and fertilizer every day to cover further domains, as the opportunity of replacing human operators provides effective solutions with return on investment. Developing countries, most precisely in agriculture sector, are affected by insufficient man power. So on the other hand, the scope of developing innovating, automatic and intelligent machineries has increased in huge amount and has become one of the trends in 21th century.Some of the major problems in the Indian agriculture are rising of input costs, availability of skilled labors, lack of water resources and crop monitoring.To overcome these problems,the automation technologies were used in agriculture. The automation in agriculture could help farmers to reduce their efforts.

These agriculture robots are equipped with arms which are specialized, end effector and many other tools in order to work on several tasks related to agriculture. Meanwhile,the population has been growing very rapidly,which is pressurizing the farmers for the rise in the yield.In this agricultural robot will play major role in supporting the farmer to address all the challenges which he is facing.The robots are being developed for the processes seed sowing,spraying of pesticides,spreading of fertilizers,ploughing and cutting of unwanted grass etc.

II. PROPOSEDMETHOD

Relay-

A relay is an electrically operated .switches Many relays use an electromagnet to manage a switch mechanically, yet other working standards are likewise utilized. Electromagnetic attraction type relay is of 12V,10A and which operates on electromagnetic attraction.It is a type of a magnetic switch which uses the magnet for creating a magnetizing field.The magnetic field then uses for opening and closing the switch and for performing the mechanical operation.Camera is connected to raspberry pi 3B+.Whenever the camera senses green plant it gives signal to raspberry pi 3B+.From raspberry pi 3 B+ signal goes to relay driver and relay operates. Henceforth,motor will get ON by relay operation.

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PMDC Motor

In a DC motor, an armature rotates inside a magnetic field. The basic working principle of DC motor is based on the Faradays law of electromagnetic induction which is, whenever a current carrying conductor is placed inside a magnetic field, there will be a mechanical force experience by that conductor.

It's essential to established magnetic field. The magnetic field is establishes by using a magnet. It can be use electromagnet or permanent magnet. A permanent magnet Dc motor is type of DC motor that uses permanent magnet to create the magnetic field required for operation of DC motor.

Raspberry pi 3B +

Raspberry Pi 3B+ is a small board computer. It has CPU, GPU, USP ports and I/O pins, Wi-Fi, Bluetooth, USB and network boot and is capable of doing some functions like a regular computer. The SOC (system on chip) combines both CPU and GPU on a package and turns out to be faster than Pi 2 and Pi 3 models.

Fig.1. Hardware kit of raspberry pi 3B+

CPU means central processing unit it performs the basic arithmetical, logical and input output operation of raspberry pi 3B+.CPU is divided into 2 parts APU and GPU.APU means arithmetic processing unit which performs arithmetic operation. GPU means graphic processing unit is a specialized electronic ckt. Using rapidly manipulate and after memory to accelerate creation of image in a frame buffer intended for output to a display. BCM 2837B0 chip is used in the raspberry pi 3B+.There are 2 USB ports and POE header.It has 40 GPIO pins and 4 pole stereo output and composite video port.It has CSI and DSI.CSI means camera serial interface and DSI means display serial interface.Raspberry pi 3B+ get supply from power supply regulator and it also takes signal from camera whenever it sense green plant.

Sensing camera -

We can use different types of camera to sense the green but here we are using sensing camera. The function of this sensor is to sense the green if particular plant is green then its will send signal to relay driver through Raspberry pi after that nozzle through pesticides spray on the plant. If it is not green then no any signal it will send to Raspbeery pi.

Fig.2.Sensing camera

III. METHODOLOGY

Battery is of 12v,35Ah is used. From battery supply is given to power supply regulator. Power supply regulator will convert unregulated AC into a constant DC. Its function is to supply a stable voltage to raspberry pi 3B+ and voltage regulator.

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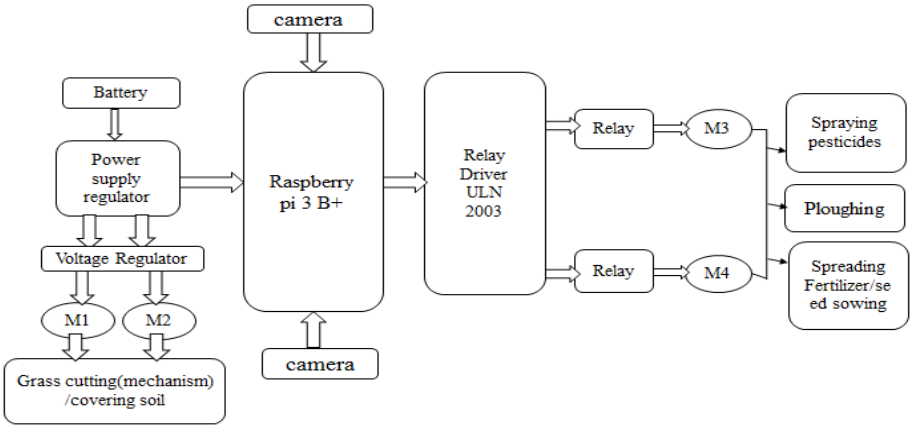

Fig.3. Functional Block diagram of the working model of agricultural robot

Raspberry pi B+ is small type of hardware circuit. It works as small computer. It has two unit that is APU and GPU. APU is Arithmetic processing unit performs arithmetic operations and GPU is graphic processing unit is a specialized electronic circuit designed to rapidly manipulate and after memory to accelerate the certain of image in a frame buffer intended for out to display device. Raspberry pi 3B+ as 40 general purpose input pins by which we can take or give the data. It has also CSI and DSI.CSI means camera serial interface and DSI means display serial interface.

Form Raspberry pi supply is given to relay driver circuit .The circuit is used for driving the relay termed as relay driver circuit and it can be designed using various integrated ckt. IC ULN2003 is a Darlington transistor array which deals with high voltage and high current compares of seven NPN Darlington pairs and it typically used to drive motors. The relay driver is connected to relay and camera.

The camera program is interfaced in Raspberry pi using python language. Camera which is used for to sense the green when it senses the green it gives command to relay to operate the motor. By using motor named as M3 and M4 we will spread the fertilizer and other two motors named as M1 and M2 which are connected through voltage regulator which will used for to run the motor and grass cutting.

IV. HARDWAREIMPLEMENTATION

Fig.4.Hardware implementation of multifunctional agricultural robot

The battery is connected to PMDC motor the rating of this motor 300rpm, 24V, and current 2.2A to 13.4A.After starting the switch the two motor are connected two wheels of the robot by using chain drive to run the motor and wheels simultaneously. The direction of the motor decides the direction of the robot i.e forward and reverse direction with the help

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of chain drive which is connected to wheels. The other motors is connected to fertilizer tank and raspberry pi 3B+ whenever the camera sense the green it gives signal to raspberry pi 3B+. Raspberry pi 3B+ given signal to relay driver hence relay gets on and automatically motors gets operated. When the camera sense the green then and then only it will spraying of pesticides otherwise it is remain just only in on mode.

After the starting the motor the operations such as ploughing and at the same time fertilizer get sprayding. We can also we replace fertilizer with seeds by which we can also perform seed sowing operation. The knob is provided to fertilizer tank to adjust the quantity of fertilizer or also seeds. The pipe is for spreading fertilizer or sowing operation and seed or fertilizers is covered with the help of soil covering blade. Also, this blade is used to cut unwanted grass.By using voltage regulator we can control the seed of the motor. As the relation voltage is directly prepositional to the speed as voltage increases speed is also increases and as voltage decreases the speed is also decreases.

V. PROGRAMAND RESULTS

```
import cv2
import numpy as np
import os
import imutils

try:
   cap=cv2.VideoCapture(0)
   cap.set(3,640)
   cap.set(4,480)

   while True:
      _,frame=cap.read()

      blurred_frame = cv2.GaussianBlur(frame, (5, 5), 0)
      hsv = cv2.cvtPlant(blurred_frame,
cv2.PLANT_BGR2HSV)

      low_green=np.array([36, 25, 25])
      high_green=np.array([70, 255,255])

      mask = cv2.inRange(hsv, low_green, high_green)
      contours = cv2.findContours(mask,
cv2.RETR_TREE, cv2.CHAIN_APPROX_NONE)
      contours = imutils.grab_contours(contours)
      for contour in contours:
         area=cv2.contourArea(contour)
         if(area > 1000):
            cv2.drawContours(blurred_frame, contour, -1,
(0, 255, 0), 3)
            cv2.imshow("Frame", blurred_frame)
            cv2.imshow("Mask", mask)
            key = cv2.waitKey(1)
            if key == 27:
               break
   cap.release()
   cv2.destroyAllWindows()
except:
   cap=cv2.VideoCapture(1)
   cap.set(3,640)
   cap.set(4,480)

   while True:
      _,frame=cap.read()

      blurred_frame = cv2.GaussianBlur(frame, (5, 5), 0)
      hsv = cv2.cvtPlant(blurred_frame,
cv2.PLANT_BGR2HSV)

      low_green=np.array([36, 25, 25])
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      mask = cv2.inRange(hsv, low_green, high_green)
      contours = cv2.findContours(mask,
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      contours = imutils.grab_contours(contours)
      for contour in contours:
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            cv2.drawContours(blurred_frame, contour, -1,
(0, 255, 0), 3)
            cv2.imshow("Frame", blurred_frame)
            cv2.imshow("Mask", mask)
            key = cv2.waitKey(1)
            if key == 27:
               break

   cap.release()
   cv2.destroyAllWindows()
```

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Result

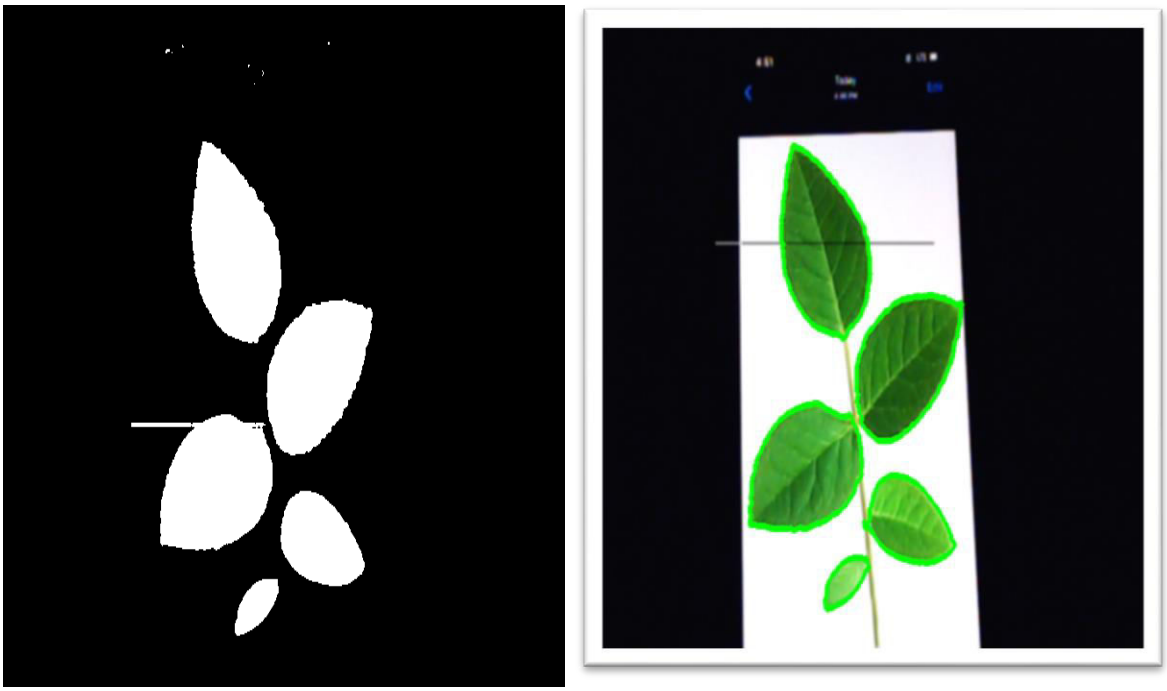

Fig.5. Program and result image.

VI. CONCLUSION

In agriculture, the opportunities for robot-enhanced productivity are immense –and the robot are appearing on farms in various guises and in increasing numbers. One of the advantages of the smaller machine is that they may be more acceptable to the non-farm community. The jobs in agriculture are a drag, dangerous, require intelligence and quick though highly repetitive decisions hence robots can be rightly substituted with human operator.

Multipurpose autonomous agricultural robot has successfully implemented and tested for various functions like Fertilization, ploughing, seed sowing, Removing unwanted grass, covering soil and water spraying. The advantages of multipurpose agricultural robots are reducing human intervention, ensuring proper irrigation and efficient utilization of resources.

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