Agribot

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Abstract: This paper deals with manufacturing development of robot in agricultural applications. The main area of application of robots in agriculture is at the harvesting stage, digging, ploughing and seeding. This robot is designed to replace human labor. This jobs involved in agriculture are not straight forward and many repetitive tasks are not required to do, so the agricultural industry is behind other industries in using robots. This project represents a robot capable of performing operations like automatic ploughing, seed dispensing and pesticide spraying. It also provides manual control when required. The main component here is the microcontroller that supervises the entire process. Initially the robot digs the entire field simultaneously dispensing seeds by side by side. On the field the robot operates on automated mode. For manual control the robot uses the remote controller as control device and helps in the navigation of the robot on the field.

Keywords **- Agribot, Arduino AtMega, Ploughing, Sowing Seeds, pesticides spraying**

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 labour and a very 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 that much. So, they were seeding by hand. But nowadays technology is developed. So now it's not necessary to do seeding in sunlight. By using robot technology, one can sit in a cool place and can-do seeding by monitoring the robot motion. In recent years, robotics in agriculture sector with its implementation based on precision agriculture concept is the newly emerging technology. 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 seed sowing task only.

Plant diseases are important factors because its affects human being as well as animals etc. that's why as it can cause significant reduction in both quality and quantity of crops in agriculture production. Therefore, detection and classification of diseases is an important and urgent task. Traditionally farmers identify the diseases by naked eye observation method. Some researchers have used image processing techniques for fast and accurate detection of plant diseases and identifying the diseases in an early stage only and control them. When some diseases are not visible to naked eye but actually they are present, then it is difficult to detect it with the naked eye. And when it is visible it will be too late to detect disease and can't help anymore. Earlier, microscope is used to detect the disease, but it become difficult as to observe each and every leaf and plant. So, the fast and effective way is a remote sensing technique. Detection and recognition of diseases in plants using machine learning is very fruitful in providing symptoms of identifying diseases at its earliest. For small scale farmers, early identification of disease is very much possible and able to control the insects by organic pesticides or by the use of minimal amount of chemical pesticides. For large scale farmers frequent monitoring and early identification of disease is not possible and it results in a severe outbreak of the disease and pest growth which cannot be controlled by organic means. In this situation farmers are forced to use the poisonous chemicals to eradicate the disease in order to retain the crop yield. This problem can be solved by automating the monitoring process by use of advanced image processing techniques and machine learning.

The proposed work aims in making the automated system easily available for the farmer's using the device for early detection of the diseases in plants. Robotic is included in this system a field robot goes through the field and captures the images of the leaves and processing of the image is done using the processor that is integrated in it. After the evaluation of the diseases the result is sent to the farmer/owner of the field in the form of SMS. The steps involved in disease detection are Digital image acquisition, Image pre-processing (noise removal, Colour transformation, and histogram equalization), K-means Segmentation, Feature extraction, and classification using the support vector machine algorithm which is a supervised learning algorithm. The processing that is done by using these components is divided into two phases. The first processing phase is the offline phase or Training Phase. In this phase, a set of input images of leaves (diseased and normal) were processed by image analyser and certain features were extracted. Then these features were given as input to the classifier, and along with it, the information whether the image is that of a diseased or a normal leaf. The classifier then learns the relation among the features extracted and the possible conclusion about the presence of the disease. Thus the system is trained.

India is well known for its agriculture production. Most of the population is dependent on agriculture. Farmers have variety of options to cultivate crops in the field. Still, the cultivating these crops for best harvest and top quality of production are done in a technical way. So the yield can be increased and quality can be improved by the use of technology. Generally, whenever there is disease to a plant, we can say that leaves are the main indicator of the disease caused to the plant. Mostly we can see the spots

on the leaves of it due to disease. However, when the amount of disease to the plant is large then the whole leaf gets covered by the disease spots.

II. LITERATURE SURVEY

In the current scenario most of us have come across the automation in various fields as the advancement of technology has to a lead tremendous development in the industrial products that have made our lives a lot easier and helpful than what our ancestors faced. The advancements especially in the field of agriculture have helped evolve a new era of development and growth of different developing countries. The atomization in this field has been a trademark for the people who are completely dependent on agriculture for their survival and other needs. Around ten papers reviewed who are worked under this area.

Agriculture contributes to a major portion of India's GDP. Two major issues in modern agriculture are water scarcity and high labour costs. These issues can be resolved using agriculture task automation, which encourages precision agriculture. Considering abundance of sunlight in India, this paper discusses the design and development of an IoT based solar powered Agribot that automates irrigation task and enables remote farm monitoring. The Agribot is developed using an Arduino microcontroller. It harvests solar power when not performing irrigation. While executing the task of irrigation, it moves along a pre-determined path of a given farm, and senses soil moisture content and temperature at regular points. At each sensing point, data acquired from multiple sensors is processed locally to decide the necessity of irrigation and accordingly farm is watered. Further, Agribot acts as an IoT device and transmits the data collected from multiple sensors to a remote server using Wi-Fi link. At the remote server, raw data is processed using signal processing operations such as filtering, compression and prediction. Accordingly, the analysed data statistics are displayed using an interactive interface, as per user request [1].

Autonomous agriculture robot is one of the promising solutions for precision agriculture. This paper presents the proposed sensor and vision based agricultural robot for sowing seeds. This prototype can navigate it on any agricultural land and perform seed sowing operation simultaneously. The onboard sensors along with vision system and vision based approaches achieves the navigation and localization tasks. Self-awareness of the robot's position is determined by the global and local maps generated from Global Positioning System (GPS) and on-board vision system paired with a personal computer. This paper also presents the proposed sensor based precision seed metering and sowing mechanism. The proposed robot is a micro planter whose primary task would be to sow seeds at prefixed seeding intervals in the field. The dimensions of the proposed robot are 26.5 × 18.5 × 19.65 mm as L × B × H respectively. A suspension system has been used to maintain the stability of the vehicle and prevent it from toppling in motion [2].

In recent years, robotics in agriculture sector with its implementation based on precision agriculture concept is the newly emerging technology. 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 seed sowing task only. It is a four wheeled vehicle which is controlled by LPC2148 microcontroller. 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 [3].

Machine intelligence is a developing technology which has made its way to various fields of engineering and technology. Robots are slowly being implemented in the field of agriculture, very soon agribots are to take over the agricultural fields and be used for various difficult and tiresome tasks involving agriculture. They have become the inevitable future of agriculture. This paper proposes an idea that will help in effective cultivation of vast areas of land left uncultivated or barren. Numerous farmers are dying during hill farming mainly due to falling from heights, which can be reduced by this technological effort. The proposed work will help in cultivation in remote areas and increase green cover as well as help farmers in harsh environments. The Agricultural Aid to Seed Cultivation (AASC) robot will be an unmanned aerial vehicle equipped with a camera, a digital image processing unit and a seed cultivation unit. A quadcopter is chosen as an aerial vehicle is independent of the form and shape of the ground and is not deterred by these factors while providing high mobility and reliability. The research aims about the new technology which can be suitable for any kind of remote farming [4].

More than 40 percent of the population in the world chooses agriculture as the primary occupation. In recent years, increased interest has grown for the development of the autonomous vehicles like robots in the agriculture. The existing agricultural robot performs basic elementary functions like harvesting, planting and spreading the pesticides. The Proposed system aims at designing multipurpose autonomous agricultural robotic vehicle which can be controlled through Bluetooth for ploughing, seeding and irrigation systems. This is especially important for the workers in the area of potentially harmful for the safety and health of the workers. These robots are used to reduce human intervention, ensuring proper irrigation and efficient utilization of resources. These robots are mainly useful in automated weed control; usage of fertilizers based on soil condition, soil sensors for drip irrigation in rain feed areas [5].

The Discovery of Agriculture is the first big step towards civilized life, advancement of agricultural tools is the basic trend of agricultural improvement. Now the qualitative approach of this project is to develop a system which minimizes the working cost and also reduces the time for digging operation and seed sowing operation by utilizing solar energy to run the agribot. In this machine, solar panel is used to capture solar energy and then it is converted into electrical energy which is used to charge battery, which then gives the necessary power to a shunt wound DC motor. Ultrasonic Sensor and Digital Compass Sensor are

used with the help of Wi-Fi interface operated on Android Application to man oeuvre robot in the field. This brings down labour dependency. Seed sowing and digging robot will move on various ground contours and performs digging, sowing the seed and covers the ground by closing it. The paper spells out the complete installation of the agribot including hardware and software facet [6].

Mango cultivation methods being adopted currently are ineffective and low productive despite consuming huge man power. Advancements in robust unmanned aerial vehicles (UAV's), high speed image processing algorithms and machine vision techniques reinforce the possibility of transforming agricultural scenario to modernity within prevailing time and energy constraints. Present paper introduces Agricultural Aid for Mango cutting (AAM), an Agribot that could be employed for precision mango farming. It is a quadcopter empowered with vision and cutter systems complemented with necessary ancillaries. It could hover around the trees, detect the ripe mangoes, cut and collect them. Paper also sheds light on the available Agribots that have mostly been limited to the research labs. AAM robot is the first of its kind that once implemented could pave way to the next generation Agribots capable of increasing the agricultural productivity and justify the existence of intelligent machines [7].

III. WORKING PRINCIPLE OF PROPOSED SYSTEM

3.1 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 with the battery. The robot requires 12V battery to operate the system. 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 seeds are dropped through drilled hole on the shaft by the linked mechanism with dug soil processing. A leveler is made to close the seeds and water pump sprayer is used for spray the water. Bluetooth technology through smart phone is used to control the entire operation of robot for ploughing, seeding and irrigation systems.

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 Zigbee and Wifi module from Android smart phone. The wireless communication of Bluetooth 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 is capable of performing operations like automatic plowing, seed sowing, and water sprinkling. The qualitative development of this project is request for a system which minimizes the working cost and reduces the time for digging task and these entire tasks run by battery source also we can adopt solar energy system. Development aim of this system is that these devices can atomically actions on agricultural operations. Now a day's formers pay lot of money for machines that help them to decrease labor and increase income of crops but efficiency and profit are less. Hence automation is the ideal solution to decrease all the failing by development of machines that performs one operations and automating to increasing the income on a large value.

3.2 Block Diagram

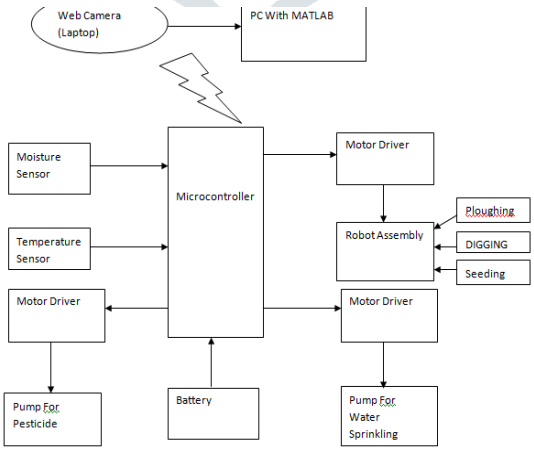

Fig. 1 Proposed Block Diagram

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 seed sowing task only. 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.

Image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame. The basic unit of image is pixels. The group of pixels will form an image.

3.3 Methodology

Many of the system designed for agriculture operations of seeding, weeding and fertilizer spraying are based on the camera and machine vision. The navigation of the vehicle is based on Wi-Fi and wireless-controlled system. Use of these systems can achieve the level of accuracy but the final cost of the product is very high. The system proposed in this paper is cost effective and does not require the costly equipment's for its navigation; it is designed to be automatic and light weight. These advantages make it real aid to farmers.

Pesticide sprayer can be used for the following purposes:

STEP1: Identifying the defective and non-defective leaves in plants.

STEP2: Classifying the type of disease attacked in the leaves.

STEP3: Pesticide spraying in defective areas.

An automatic pesticide sprayer is involved to spray the pesticide to the localized area of the affected crops. This system is based on the sprayer that is filled with pesticide. This provides a continuous flow of pesticide and an accuracy that is not affected by varying fluid properties and flow conditions and also sprays pesticide on affected area of plant by adjusting the height of pesticide sprayer. This can be controlled by using MATLAB software through mobile remotely. The design is ideal for pesticide sprayer application.

IV. RESULT AND 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 three separate functions.

1. Digging
2. Hopper
3. Leveler
4. Disease Detection

These will be working in different modes. Programming of different modes will be done separately the different modes.

The result of this research can be seen from accuracy that calculated from several combinations of features. Table 1 shows classification accuracy of this research. When single feature is used, shape feature has the lowest accuracy of 51% because rust in sugarcane has various shape of lesion so it is difficult to analyze it by solidity, extent, minor axis length and eccentricity of image. But, normal and diseased images have different shape. Healthy leaf has no lesion and rust diseased leaf has lesion, so system can recognize the pattern.

Table.1 Classification Accuracy

Features	Accuracy
Shape	51 %
Color	87 %
Texture	96, 5 %
Color + Texture	97, 5 %
Color + Shape	86, 5 %
Shape + Texture	96 %
Color + Shape + Texture	97, 5 %

4.1 Digging

Here obtained a new technology for sowing the seeds in a particular order. The seeds are placed with some specific gap between them and which is different for every crop. So in order to overcome the problem, robot this will itself dig the soil and place the seeds. Table 2 explains placement of seeding.

Table.2 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)	5.3 cm

4.2 Hopper

Hopper is used to carry seeds and to drop the seed at a particular hole that is being dig by agribot.

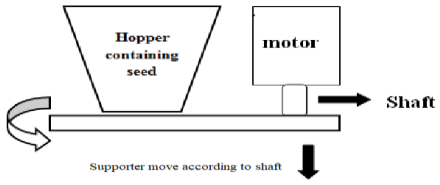

Fig.2 Hopper

4.3 Leveler

Leveler is placed at front of the robot. This will help to make an uneven surface to a flat shape. This will work simply by making Front actuators come down. When robot a start moving forward, the even surface has up's and down's leveler will make all the area to flat surface. This is very compatible for levelling gardens, small areas, closing gaps, etc.

Fig.3 Leveler

4.4 Sprinkler

This is lightweight, small size, high efficiency, low consumption and low noise water pump. It has been used widely; in household include cooking, cleaning, bathing, space heating and water flowers, etc.

Fig.4 Micro submersible pump

4.5: Data Sheet for Moisture Level Required

Table 3 explains the data sheet of moisture level required in the soil for different crops.

Table 3: The data sheet of moisture level Proposed model

Crops	Humidity (%)	Moisture level
Corn	65	33
Yellow corn	65	15.3
Soybean	65	12.6
Wheat	65	13.8
Barley	65	19
Jute	65	13.7
Paddy	65	24

Fig .5 robot assembly

V. CONCLUSIONS AND FUTURE SCOPES

Multipurpose autonomous agricultural robot has successfully implemented and tested for various functions like ploughing, seeding, leveling and water spraying. It was developed by integrating agricultural robot with C programming. Application of inexpensive navigation sensors to the robot farming system makes the system economically adaptable with the environment. With the development of robot farming system, food production can be increased considerably and economically.

This project proposed a leaf image pattern classification to identify disease in leaf with a combination of texture and color feature extraction. Initially the farmers send a digital image of the diseased leaf of a plant and these images are read in MATLAB and processed automatically based on SVM and the results were shown. The results of this project are to find appropriate features that can identify leaf disease of certain commonly caused disease to plants. Firstly, normal and diseased images are collected and pre-processed. Then, features of shape, color and texture are extracted from these images. After that, these images are classified by support vector machine classifier. A combination of several features is used to evaluate the appropriate features to find distinctive features for identification of leaf disease. When a single feature is used, shape feature has the lowest accuracy and texture feature has the highest accuracy. A combination of texture and color feature extraction results highest classification accuracy. A combination of texture and color feature extraction with polynomial kernel results in good classification accuracy. Based on the classified type of disease a text message was sent to the user in the project.

With fully-automated farms in the future, robots can perform all the tasks like mowing, fertilizing, monitoring of pests and diseases, harvesting, tilling, etc. This also enables the farmers to just supervise the robots without the need to operate them. The project can be enhanced to any other kinds of crop. Hence, it can be applicable to the real time agricultural field. The project can be extended for more disease in future. In future a robot can be sent to spray the pesticides to the plants automatically without human interaction.

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